

PUBLIC WORKS

Dec.
1957

CITY, COUNTY AND STATE

RESEARCH IN SANITARY ENGINEERING

*Fourteen articles in a
special section give some
highlights of current work
in water treatment and air
and water pollution control*
pages 73 to 96

**County Spends
\$1,000,000 a Year on
HIGHWAYS**
page 97

**Accounting Machines Cut
WATER BILLING COSTS**
page 103

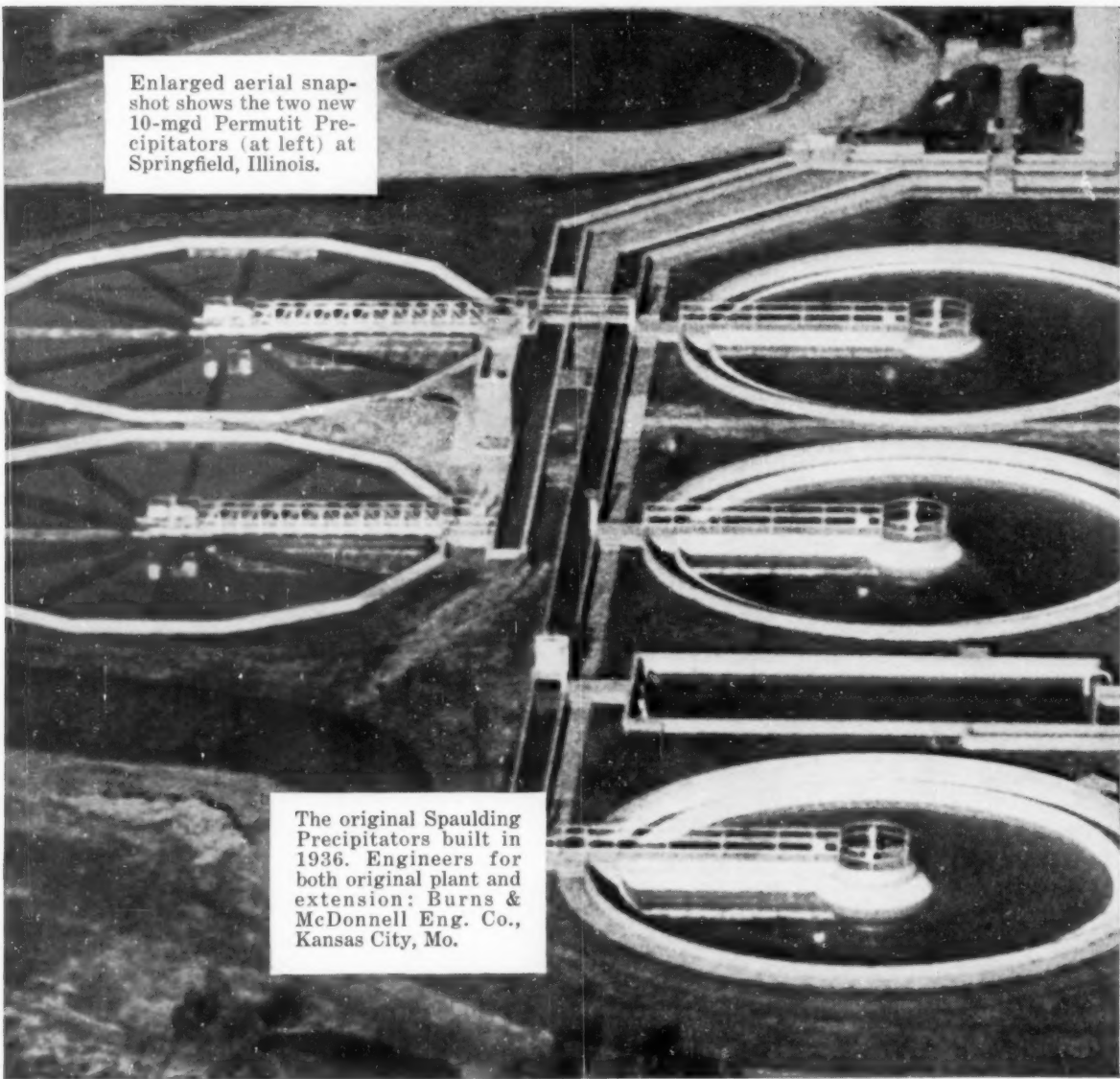
**How A Good Inventory
System Helps
TRAFFIC SIGN PROGRAM**
page 107

**Refuse Disposal by
INCINERATION
Gives Income, Too**
page 115

**COMPLETE CONTENTS
LIST ON PAGE 5**



Harry G. Hanson is Director of the Robert A. Taft Sanitary Engineering Center at Cincinnati, where a broad program of research is under way on many phases of environmental sanitation. More information on page 18.



Enlarged aerial snapshot shows the two new 10-mgd Permutit Precipitators (at left) at Springfield, Illinois.

The original Spaulding Precipitators built in 1936. Engineers for both original plant and extension: Burns & McDonnell Eng. Co., Kansas City, Mo.

20-year record proves efficiency of upflow "Precipitators"

In 1936, Springfield built three short-detention, upflow softening-coagulation units newly developed by Charles H. Spaulding. From the start, the Spaulding-designed units showed high flow rates — many times faster than the old basin system, a uniform quality effluent that doubled filter capacity, a low chemical cost and a low maintenance cost.

When Springfield's recent expan-

sion program called for doubling its water-treating capacity, city engineers had almost 20 years of proven performance to guide them, a longer performance record than is available with any other type of upflow, sludge-blanket unit. That's why Permutit Precipitators based on Spaulding designs were chosen for the new units.

For complete details on any type

of water conditioning equipment, write: The Permutit Company, Dept. PW-12, 50 W. 44th St., New York 36, or Permutit Company of Canada, Ltd., Toronto 1, Ont.

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Kennedy School, Louisville, Ky. • Hurstern, Louis & Henry and E. R. Ronald & Assoc., Consulting Engineers • Plant Maintained by School Custodian.

HOW HEAPS OF WASTE HELP ELIMINATE A CITY HAZARD



Near Geneva, Illinois, an old quarry made an exciting playground for youngsters who didn't recognize its hazards. Recently three children drowned in its waters. The city decided to fill in the treacherous pit.

Carloads of waste from nearby foundries were trucked to the area, to be dumped quickly into the quarry by Geneva's busy No. 933 Traxcavator*. A city hazard was eliminated.

About the No. 933, Street Supt. Walter Gobil says, "We're well satisfied with what it's doing—and we've had it on some tough jobs that proved it will handle all our heavy work, from road construction to leveling the city dumps." Geneva has three dumps and levels them regularly. "As far as we're concerned," Mr. Gobil says, "the No. 933 is the best all-around machine for our type of work."

The improved No. 933 (Series E) is one of three Cat-built Traxcavators, offering bucket capacities from 1 to 2¼ cu. yds. For the really rough jobs, each model now features a new heavy-duty undercarriage, with new rugged track roller frame, new solid sprockets, new heavier idlers, new tough track rollers.

For a demonstration on your own job, get in touch with your Caterpillar Dealer. Remember him, too, for expert service and for CAT* parts you can trust.

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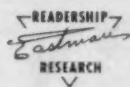
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PUBLIC WORKS DIGESTS

Water Works	132
Highway and Airport	140
Sewerage and Refuse	150
Industrial Waste	160

DEPARTMENTS AND SECTIONS

The Editor's Page	7
Leaders in Public Works	18
Public Works Engineering	
Notes	30
Reviews of Catalogs	38
Legal Notes	65
APWA News Bulletins	119
Books in Brief	164
New Equipment	179
Worth Selling	187
Worth Telling	188



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HIGHLIGHTS OF RESEARCH IN SANITARY ENGINEERING

This sampling of current research in environmental control problems reveals programs of wide scope and with many facets, but the impact of known future problems points up a scientist and fund shortage.

Public Health Service Research Grants Program	73
From Ohio River Surveys to a Clinic for Sanitary Engineering Problems	75
Corrosion Studies	78
The Survival of Pathogenic Organisms in Sewage	80
Biological Treatment of Tannery Wastes	82
Origin of Tastes and Odors in Drinking Water	83
Treatment of Radioactive Laundry Wastes	85
Detergent Break-Down and Air Pollution by Inefficient Combustion	87
Advancement in Bacteriology and Analytical Methods	89
Rates and Mechanisms of Reactions Involving Oxy-Chloro Compounds	90
Surface Reaeration of Water as Affected by Domestic Sewage	92
Experimental Sand Filters for Airborne Radioactive Particulates	93
Toxicity Investigations on Aquatic and Marine Life	94
New Concepts of Sedimentation	96
Operating a County Highway Department	97
Design and Maintenance of Roadside Parks	100
How a City Cut Water Costs	103
Subsurface Explorations by the A-G Soil Penetrometer	105
Detailed Inventory Aids Traffic Sign Program	107
Calculators Save Time for County Highway Department	109
Operating Louisville's New Incinerator	110
Dust Control	112
Chattanooga's Electric Traffic Control System	115
Conservative New England City Goes On the Air	116
How to Use Lanterns for Highway Warning and Lighting Barricades	148
Poz-O-Pac Road Base Shows Low First Cost and High Quality	166
Recharge Operations Can Conserve Water Resources	171

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES



AMPLE DEFLECTION
Photo shows how easily Clow Bell-Tite joints handle casual curves or normal grades without fittings.



TIGHT JOINTS
Full length, restrained joint, bursting tests prove Bell-Tite joint, even fully deflected, is stronger than the pipe.



FAST INSTALLATION
Above, Clow 8" Bell-Tite pipe being installed at the rate of 25 joints per hour. No bell holes are required.



SIMPLE ASSEMBLY
Wipe clean, lubricate, and push spigot into bell. When painted yellow stripe disappears, joint is bottle-tight!

you

get

all

this

with

CLOW BELL-TITE JOINT*

cast iron pipe

Here's the new time-saving, labor-saving, money-saving way to lay watermain. A single gasket, rubber seal joint that requires no bolts or follower glands to make a tight, dependable joint. Listed by the Underwriters' Laboratories, Inc., for water working pres-

*Patent applied for.

ures up to 350 psi, the pipe itself meets all applicable provisions of AWWA, ASA, and Federal Specifications. Complete details gladly rushed to you on request.

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POINT OF VIEW

Engineers Need Experience in Administration and Management

RECENT ENGINEER shortages have resulted in some tendency toward restriction of engineers to purely engineering work, to the measurement of engineering production and to the ultimate development of super-specialists in engineering; but these policies do not produce engineering administrators.

City, county or state engineers, as well as men in many other generally similar positions, must be well qualified engineers, but they also must have experience in management and administration. They cannot be narrowly trained; their responsibilities and opportunities are too great.

So in our efforts to utilize every drop of engineering skill in jobs that require these abilities, let us not forget that we must also develop engineers with skill and knowledge in management and administration. Our shortage of engineers will pass—if it is not already over the peak—but the demand for engineers with broad abilities in management will persist and increase. Now is the time to train our young men to meet these important future needs.

A Report on Progress in Sanitary Engineering Certification

A TOTAL OF more than 1270 applications for certification have been received by the American Sanitary Engineering Intersociety Board. This large number, considerably in excess of expectation, has imposed a very heavy work load on the Specialty Committee and the Board. It is necessary to write for letters to the references given; to examine the record of experience; and to evaluate the background resulting from a consideration of all the data.

The Specialty Committee and the Board met on Oct. 17 and 18 in New York in connection with the ASCE meeting and passed on 434 applications. Of these, 317 were approved; 22 were held for more information; 49 were recommended for examination and 46 were disapproved. Including those previously considered, about 750 applications have been processed. About 500, still on hand, are being checked and will be considered at the next meeting which will probably be in March or April.

Most of these applications were from men with 15 years or more experience under a clause which permits certification without examination for those

meeting full requirements and applying before Oct. 1, 1957. Hereafter, all applicants must take a special examination. On Oct. 17, the first examination was held, four men taking the tests. Experience with this examination indicates that revisions of the basic questions, at least, will be necessary. Questions are of the multiple choice type primarily.

At this time, it is not possible to anticipate just when certificates will be issued to those approved at the recent meetings. The records pertaining to these meetings must be written; additional information obtained regarding some of the applicants; letters written to the references given by those several hundred applications that came in just before the Oct. 1 deadline; and all this information collected and evaluated. The program has involved a tremendous amount of work but it has already proven the demand for special recognition for this branch of engineering; and it gives promise of wide usefulness in application to other fields.

Conventions and Convention Papers

THE SEASON for conventions is about over and there is a brief period for resting the feet before Christmas shopping time. In the meantime, convention reactions are in order and our first reaction is that too many of the papers are unduly high-brow.

For every expert in a field there are probably ten men without special skills in higher mathematics, chemistry and physics. These ten are charged, nevertheless, with problems of basic design, operation and maintenance for cities, counties and states. They are the men who must provide public works services to the people of their communities; and they ought to be given primary consideration in preparing a convention program.

Books-of-the-Month for Engineers

MOSTLY ENGINEERS are not inclined to build up an adequate library of engineering books. It is true that in the strictly public works engineering field, there are not a great many really useful texts, but engineers engaged in public works occasionally need and should have texts in ancillary fields. So we welcome a recent announcement of a book-of-the-month type club for engineers. We wish for it every success because in its success will be benefit for engineers.

whatever the problem . . .

Two things you're sure of when you use cast iron pipe. It will do the job. It will last.

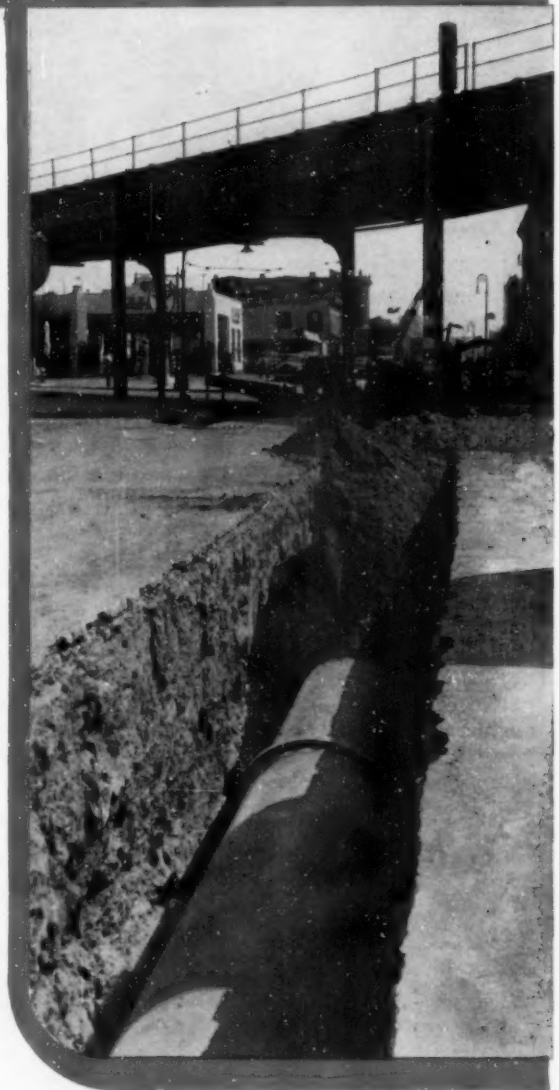
Proved in *water* service . . . for fire protection, feeder and distribution mains, purification plants.

Proved in *gas* service . . . for feeder and distribution mains.

Proved in *sewerage* systems . . . for force mains, outfalls, treatment plants.

Engineers everywhere are familiar with cast iron pipe's outstanding record. They specify it because it's versatile . . . because its rugged strength has served for centuries. And, today, *modernized* cast iron pipe, centrifugally cast, is even stronger, more durable.

For information, write: Cast Iron Pipe Research Association, Thomas F. Wolfe, Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Illinois.



Brooklyn, N. Y.—Laying 42" Mechanical Joint cast iron pipe for gas main.



Cast Iron Pipe Research Association, Thos. F. Wolfe,
Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Ill.

CAST IRON PIPE

wherever the job



▲ **Portland, Ore.**—Large diameter cast iron sewer lines being installed across Willamette River, part of program to restore normal river conditions for salmon spawning.

St. Louis County, Mo.—36" cast iron intake line at the North County Water Plant of the St. Louis County Water Company. ▼



SERVES FOR CENTURIES...

Protect your community's health **SIX WAYS** with longer, stronger **AMVIT** Clay Pipe

Outstanding Mechanical Joint on pipe over 4 feet long One of your City's Lifelines

Each year thousands of taxpayer's dollars are *wasted* on "substitute" materials used in sewer lines. Failure and collapse of non-clay sewers endangers the health of the community. Sewers must be constructed of permanent materials for they carry to safe disposal thousands of tons of waste laden with dangerous and deadly bacteria.

Amvit Jointed Clay Pipe gives decades of uninterrupted underground service. Neither joint nor pipe is affected by these factors:

1. ROOTS



force the pipe out of line and clog the system in search of moisture. Amvit is a compression joint on the ball and socket principle. The surfaces of both bell and spigot are in constant compression. Roots cannot enter the line.

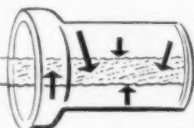
2. CHEMICAL ATTACK

is from acid-laden, high temperature sewage, discharged from dishwashers, garbage disposal units and washing ma-

chines. Like the clay pipe, Amvit Joint is acid resistant and will not corrode or decompose.

3. FLOW LINE ATTACK

refers to that section of the pipe which lies between low and high water. Grease and scum tend to build up here and acts as a solvent on certain synthetic substitute pipes. The design of the Amvit Joint assures that the pipe is self centered at all times. This gives perfect alignment and self-cleansing.



4. EROSION

is the wearing out of pipe by abrasive action of sand and gravel. Soft pipes become scratched and roughened and tend to clog up. Because Amvit is a really tight joint, no foreign matter can possibly enter the line.

5. DECOMPOSITION

is the chemical breakdown of the component elements of the pipe. Only clay pipe resists decomposition. Like the pipe, the joint is unaffected by ordinary conditions of underground service.

6. RODENTS AND TERMITES



will gnaw away wrappings and coatings of pipe. Amvit Clay Pipe defies even the sharpest toothed rodent and is immune to termite attack.

For more information on how Amvit can help cut your sewer project costs, write or call American Vitrefied Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you.



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Are your residential streets alive after dark?

Few municipal services are as noticed and appreciated by the average citizen as good street lighting on the block where he lives.

For one thing, he can't miss its very *visibility*. He knows it enables his children to play outside, or his wife to stroll to the neighbor's—safely—after dark. He likely notices a more cheerful atmosphere and greater sociability around the neighborhood than before modern street lighting was installed.

Besides, his home is his largest material investment. He likes the night-long "police protection" that the

light gives against break-in and other crime. And, after all, why should modern residential streets have old-fashioned lighting service—a puddle of light up at the corner, if any at all?

Good street lighting is a bright symbol of good municipal service. It's an example for your taxpayers to see *and remember* every night. Compare the low cost of \$2.50 to \$4.00 per capita annually to any other municipal service you can provide. This low cost—a national average—is the total needed for good lighting—city limit to city limit. Shouldn't 1957 be *the year* for your community?

"OUT OF DARKNESS," a new, dramatic film story of how one community met its street-lighting problems, is now available to civic groups, community service organizations, etc. This 16-mm, sound, black and white movie runs 26 minutes. Borrow a print of "Out of Darkness" from your nearest General Electric Apparatus Sales Office, or write our Schenectady, N. Y., Office.

Section G455-17

General Electric Company, Schenectady, New York

Please send me a free copy of the 16-page bulletin on residential street lighting.

NAME _____

STREET _____

CITY _____

STATE _____

GENERAL  ELECTRIC

SAN ANTONIO LOOKS TO 1970.... with its NEW Traffic Signal System



153 intersections now controlled by ELECTRO-MATIC® PR SYSTEM

Handling today's traffic is difficult enough, but to provide signal controls for expected 1970 traffic volumes is a major accomplishment. San Antonio did just that. They selected a flexible, versatile system that not only puts an end to downtown traffic snarls but insures movement of maximum volumes in the years to come.

An ultramodern all-electronic "PR" System controls 153 intersections in the heart of vital, growing San Antonio. All changes in volume and direction of traffic are constantly recorded and the most effective signal indications automatically computed and put into effect smoothly and without delay.

For details on how the PR System can help your city grid or arterial traffic, write for Bulletin No. E-224.



"PR Local"



AUTOMATIC SIGNAL DIVISION

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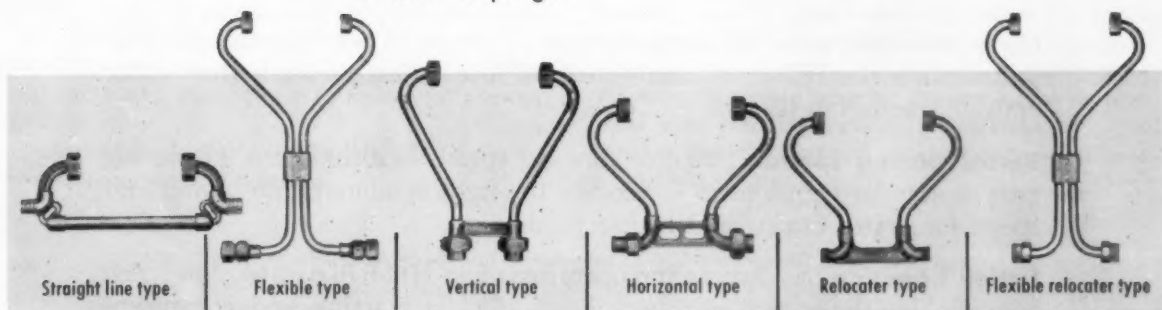


if your meter settings look like this... try this!

Just count the fittings...

- 4—Nipples
- 3—Elbows
- 1—Reducing Elbow
- 1—Bushing
- 1—Coupling
- 1—Union
- 2—Meter Couplings

OR 1—Mueller Copper Meter Yoke



Mueller Copper Meter Yokes for any installation!

*Call your Mueller Representative
or write direct for details on the full line
of Mueller meter setting equipment.*

Since 1857



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Allis-Chalmers HD-6

63 belt hp

up to 15,500-lb drawbar pull

forward speeds from 1.5 to 5.5 mph

reverse to 4.1 mph

15,850-lb (approx. as illustrated)



**MORE DRAWBAR PULL . . . BETTER DOZING SPEEDS
EASIER HANDLING . . .**

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More drawbar pull for extra output . . . up to 44 percent more drawbar pull enables the HD-6 to handle tougher jobs — bigger loads than other crawler tractors in its size.

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Engineering in Action

Two New High-Capacity Asphalt Plants Announced by Barber-Greene

These two new continuous asphalt plants give greater versatility than ever before available. The same mixer, without alteration, may be used with any combination of plant components to produce all types of mixes—from the simplest cold mixes to the highest types which must meet the most rigid specifications. Model 847 is for high capacity. Model 848-A is for extra high capacity.

It is only necessary to transport and operate the components required for the job:

For cold mixes: Mixer + calibrated feeder

For intermediate hot mixes: Mixer + calibrated feeder + dryer

For high-type mixes: Mixer + gradation unit + dryer



Plant with four-bin gradation unit for production of highest type mixes. This multiple-aggregate plant is available in both sizes.



Cold-mix plant, available in both sizes, consists of mixer and calibrated feeder. Dryer and gradation unit may be added later.

Both models offer these advantages:

- Unequaled versatility as described above.
- New hydraulic clamshell discharge gate saves truck time, prevents segregation.
- Transfer pump assures constant head of asphalt for metering pump, eliminates need for asphalt storage tank on mixer.
- Interlocked aggregate and asphalt feeds assure constant, correct proportioning.
- Truck pit no longer required.
- Highly portable plant components allow fast travel between jobs, pay off in more days of operation per season.
- Erection is merely a matter of spotting the units at the plant site and dropping the jacklegs.
- New, easier calibration of single-aggregate and cold-mix plants.

57-12-A

Write for information on these two new flexible high-capacity asphalt plants.

Barber-Greene

AURORA, ILLINOIS, U.S.A.



CONVEYORS...LOADERS...DITCHERS...ASPHALT PAVING EQUIPMENT

PUBLIC WORKS for December, 1957

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Doubles Multiplies

You command up to twice the refuse-disposal capacity of an old-fashioned "single-action" loader—with an International Drott 4-In-1.

You command the four basic refuse-handling actions that make sanitary landfill succeed in a big way. All at a fingertip touch of exclusive 4-In-1's machine-selector lever!

You increase the capacity of sanitary landfill sites—by controlled spreading, compacting, covering, and pressure-sealing refuse with a 4-In-1.

You get smog-freedom; rout rodents and insects; rid your community of dump-stench—all at one low cost with a 4-In-1.

You get versatility unlimited, to handle dozens of other municipal digging, 'dozing, grading, and loading jobs besides refuse disposal. Only the four sizes of 4-In-1 give you famous and exclusive pry-action break-out—for digging tough stuff where other loaders are "out of the running." And only the 4-In-1 has the performance protection of shock-swallowing Hydro-Spring!

Measure the efficiency and economy gains your community can make with an International Drott 4-In-1—on sanitary landfill—in sand or gravel pit, or quarry—on street and park duties. Compare what it means to get 4-machine utility for one moderate investment. See your International Drott Distributor for a 4-In-1 demonstration!



Refuse-spreading action. Using 4-In-1's clamshell action, (see large picture), the operator readily picks up and carries such bulky, hard-to-handle cast-offs as old tires or tree stumps—and easily "layers" the material, to simplify covering and orderly disposal...Or he can evenly spread many materials, where dumped, using 4-In-1's radius-controlled bulldozer action.

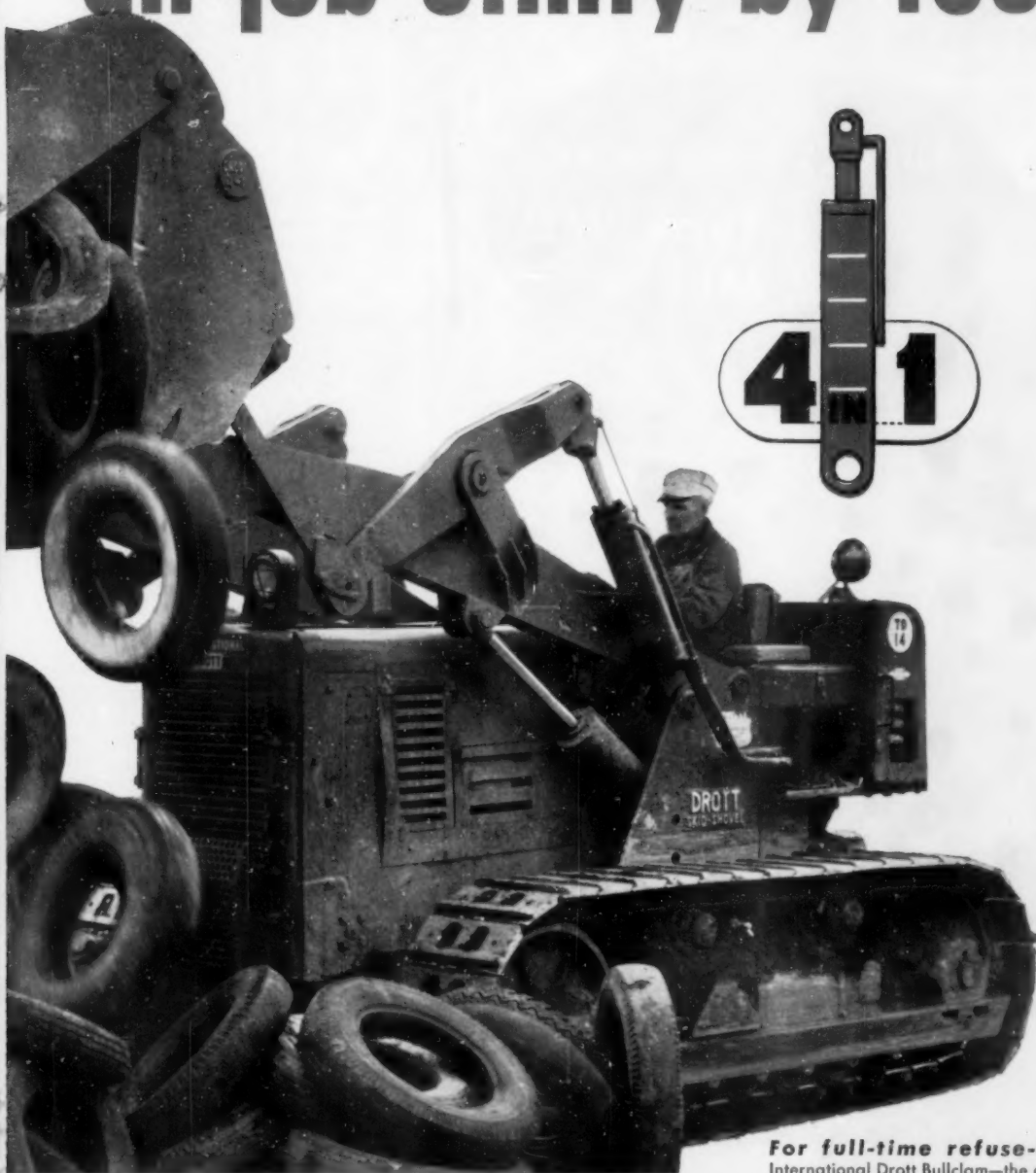


Refuse-crushing action. To crush and compress cans, cartons, and similar materials, simply roll the lowered 4-In-1 forward—and apply compactor-plate ironing action, on the go! Increase down-pressure, hydraulically, to flatten stubborn stuff!



Refuse-covering-sealing action. Obtain cover dirt from "borrow" area or stockpile, using 4-In-1 Skid-Shovel or "carry-type scraper" action. Then spread the cover evenly, on the go. Iron down the cover, using loaded bucket weight plus hydraulic down-pressure on compactor plate.

refuse handling capacity all-job utility by four!



For full-time refuse-handling—the International Drott Bullclam—the only special-purpose, all-action sanitary landfill machine. (See view below.)

International Harvester Company, 180 N. Michigan Ave., Chicago 1, Ill.
Drott Manufacturing Corp., 3126 South 27th St., Milwaukee 15, Wis.



INTERNATIONAL®
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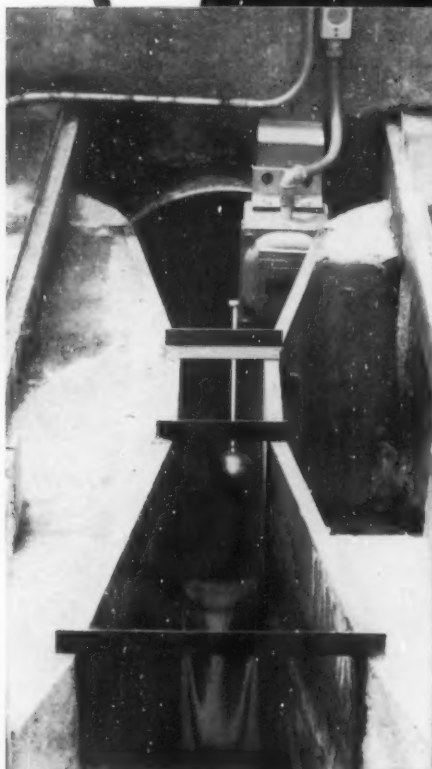
A New Concept in Measuring Flow

Through Parshall Flumes

NOTHING ELSE LIKE IT!

The
BURGESS-MANNING

**Type "ML"
METER**

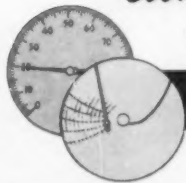


Completely eliminates

- Excavation of dry well foundation.
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- Connecting telltale piping, valves and fittings between Parshall Flume and float well.
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- Metal grating to cover dry well.

*Think of the savings!
Think of the
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Penn Instruments Division

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**Instrumentation and Controls
for water, steam, gases, sewage and industrial wastes**



**LEADER
IN
PUBLIC WORKS**

Harry G. Hanson was born at Crookston, Minnesota; he received his basic education in public schools there, and attended North Dakota State College at Fargo where he obtained his BS degree in chemical engineering. He did graduate work in public health at the University of Minnesota and later attended Harvard University, receiving a degree of Master of Sanitary Engineering.

He entered the public health field as a sanitary engineer with the North Dakota State Department of Health. After a brief period of service, he was named first as assistant director and later as director of the State Division of Sanitary Engineering. Joining the Public Health Service in January, 1942, he was stationed briefly in Washington and then transferred to Atlanta where the malaria control activities of the Service were centered. He was with the Office of Malaria Control in War Areas throughout the war years and continued there for a time after it became the Communicable Disease Center, serving as executive officer to the Director of Operations and later as executive officer of the CDC.

In October, 1947, he was transferred to Washington as an assistant in the Office of the Surgeon General; in January, 1948, he became Executive Officer to the Surgeon General which position he held until 1953 when he became Assistant Chief Engineer of the Public Health Service. He remained in this post until he was made Director of the Robert A. Taft Sanitary Engineering Center, in August, 1954.

FORD GIVES YOU MORE FOR '58



MORE POWER
MORE SELECTION
MORE HANDLING EASE
MORE MOBILITY
MORE ECONOMY

NEW FORDS GIVE



NEW FORD POWERMASTER

...MORE EASE OF HANDLING

Work-easy power steering is available for all Ford Tractors to give fingertip steering control even in curbed areas, on soft ground or over rough terrain. Ford's power steering* gives 90% assist—leaves just enough manual control for the operator to retain "feel" of the wheel. No steering wheel kick-back, no lost motion . . . and the sharp reduction in operator fatigue shows up dramatically in the form of increased production!

*Standard on Row Crop Models. Optional on others.

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TRACTOR LOAD	STEERING WHEEL TORQUE—FT.-LBS.	
	Power Off	Power On
Empty Loader	35 to 95	3 to 9
1000 lb. bucket load	100 lbs.-plus, according to terrain	5 to 9



YOU MORE POWER...

MORE SELECTION

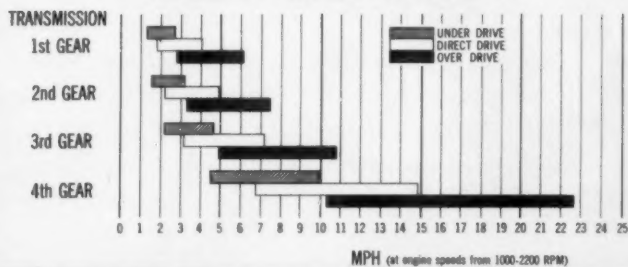


NEW FORD
WORKMASTER

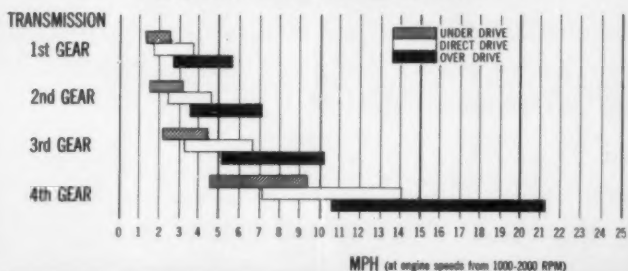
The most powerful Ford Tractors ever! There's a wide choice of new Ford All Purpose Tractors — in both the economical Workmaster series and the husky Powermaster series. Ford's new All Purpose Workmasters and Powermasters give you full range of equipment selection . . . from the Special Utility models, lowest cost work horsepower on the market, right on up through the fully equipped deluxe Model 861 Powermaster. All new Ford Tractors are available in gasoline or LP-Gas models. There's no waste investment for unneeded "frills" with the new Ford Tractors. Buy horsepower, weight and equipment to exactly fit *your* job! See your Ford Tractor and Equipment Dealer — or write Industrial Department, Tractor & Implement Division, Ford Motor Company, Birmingham, Michigan.

12-SPEED OVER-UNDER TRANSMISSION

POWERMASTER TRACTORS



WORKMASTER TRACTORS



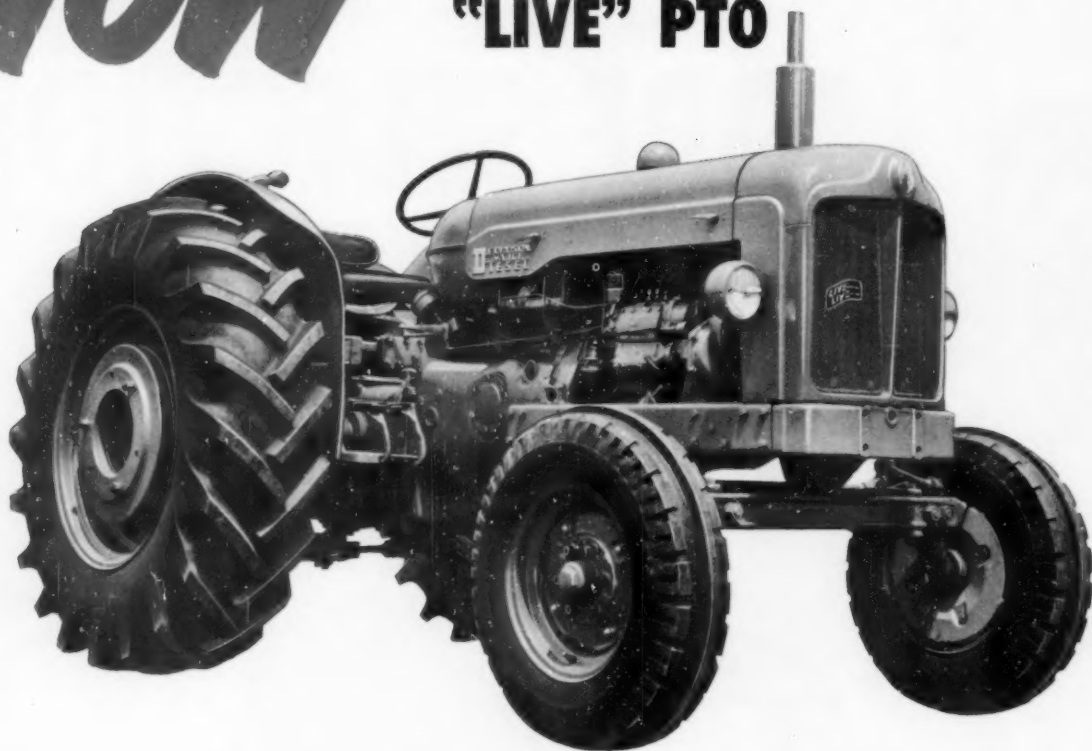
... MORE MOBILITY

Ford's new Powermasters and Workmasters are available with choice of 4-speed or 5-speed transmissions. Four speed transmission can accommodate an "over-under" auxiliary transmission giving 12-speeds forward, 3 reverse and 3 PTO. They're your answer to any speed need from one-mile-per-hour creeping for finish grading and transplanting to more than 20 mph for fast transport.

Four-speed transmission models also accommodate a reversing transmission for work with a fork lift. All controls are simple, no high-priced "specialists" are needed to operate Ford Tractors and equipment. Any man on your job can keep the work moving on schedule!

NOW

POWER STEERING AND "LIVE" PTO



FORDSON MAJOR DIESEL

Power steering and "live" PTO are now being offered as factory options for the Fordson Major Diesel — already famous world over for fuel economy. Power steering adds still more mobility and ease of handling to the FMD, and with live PTO you can make still more use of the tractor's tremendous lugging power and versatile 6-speed transmission. Choose from four special utility and fully equipped models.

Amazing economy — Unbiased tests give dramatic proof of the FMD's amazing

economy of operation. Still further savings are offered by FMD "Special Utility" models — work horsepower at a rock bottom price for industrial jobs where no hydraulic system is needed. And the same emphasis on money-saving is also found in Ford's gasoline and LP-Gas model tractors . . . low original investment, low operating cost, low maintenance cost. More of the economy that has always been traditional with Ford! See your Ford Tractor and Equipment Dealer.

YOU SEE MORE **FORDS** BECAUSE THEY SAVE MORE MONEY!

WATERSPHEROID[®]

Landmark of Dependable Water Service

The pleasing symmetry of Horton Waterspheroids[®] meet the aesthetic requirements of growing communities and are sensibly engineered to provide five benefits that make them easy and convenient to maintain:

- minimum ground area is required
- external ladders are eliminated
- smooth exterior reduces painting costs
- base can be used for storage or pumps
- can be pickled and painted before shipment

Waterspheroids are built in capacities to 500,000 gal. Write our nearest office for details. Find out how other growing communities are using them to provide dependable gravity pressure water storage to meet increased usage requirements.

◀ 500,000-gallon Waterspheroid graces skyline of Ocala, Florida. Structure is 132 feet to bottom with a range in head of 30 feet.

M-37C

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • South Pasadena • Tulsa

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.



why work like

No need to when you lay Tyton Joint® pipe. This quick and easy-to-assemble pipe goes in so smoothly it's a pleasure to work with.

Only one accessory needed—a simple rubber gasket that fits in the receiving pipe bell and is compressed by the entering spigot to permanently seal the joint. No bell holes. No weather worries. Tyton Joint can be laid in rain or wet trench.

A word of warning, however: make sure your trenching machine gets an early start or



a dog?

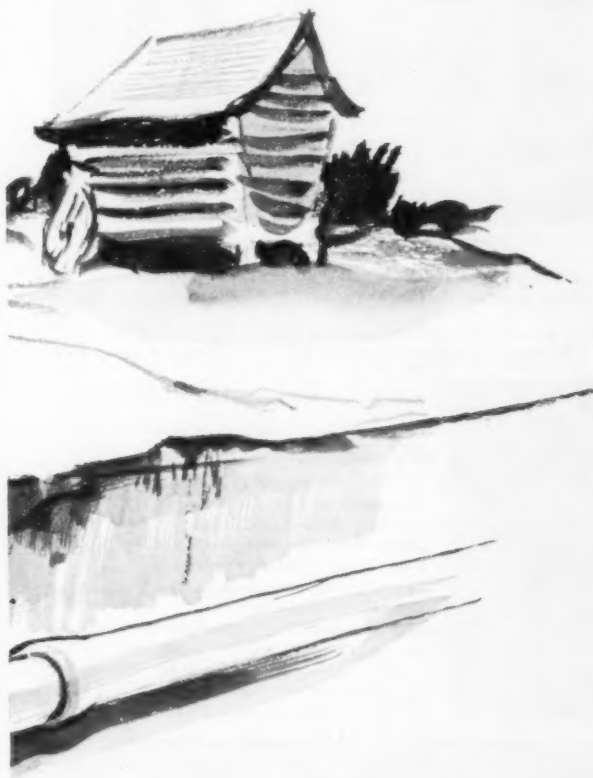
your laying crew—even an inexperienced one—will catch up fast.

Like all the facts on this new, time-and-money-saving pipe? Call or write today.

U. S. PIPE AND FOUNDRY COMPANY

General Office: Birmingham 2, Alabama

A WHOLLY INTEGRATED PRODUCER FROM MINES
AND BLAST FURNACES TO FINISHED PIPE



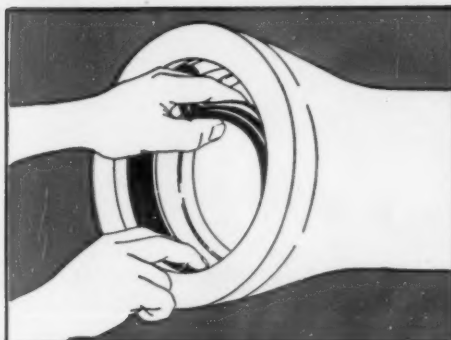
"WE NEED A COUPLE MORE DAWGS,
GRAN'MAW...WE'RE LAYIN' THE
TYTON FASTER'N THEY KIN DIG"

INDUSTRIAL SERVICE

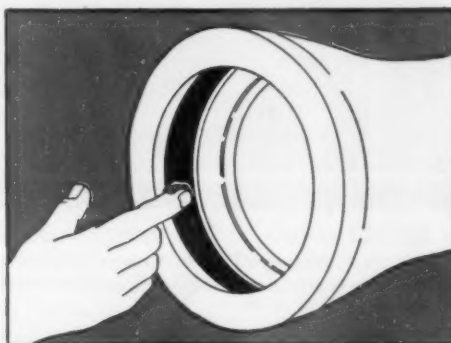
CAST IRON

U. S. **TYTON** JOINT

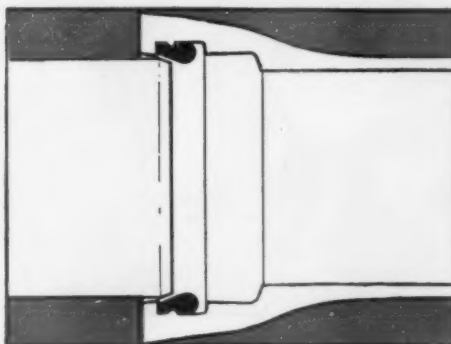
ONLY FOUR SIMPLE ACTIONS



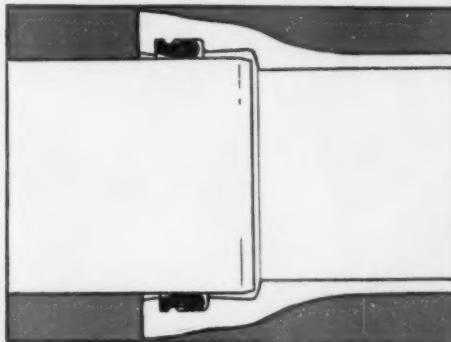
Insert gasket with groove over head in gasket seat



Wipe a film of special lubricant over inside of gasket

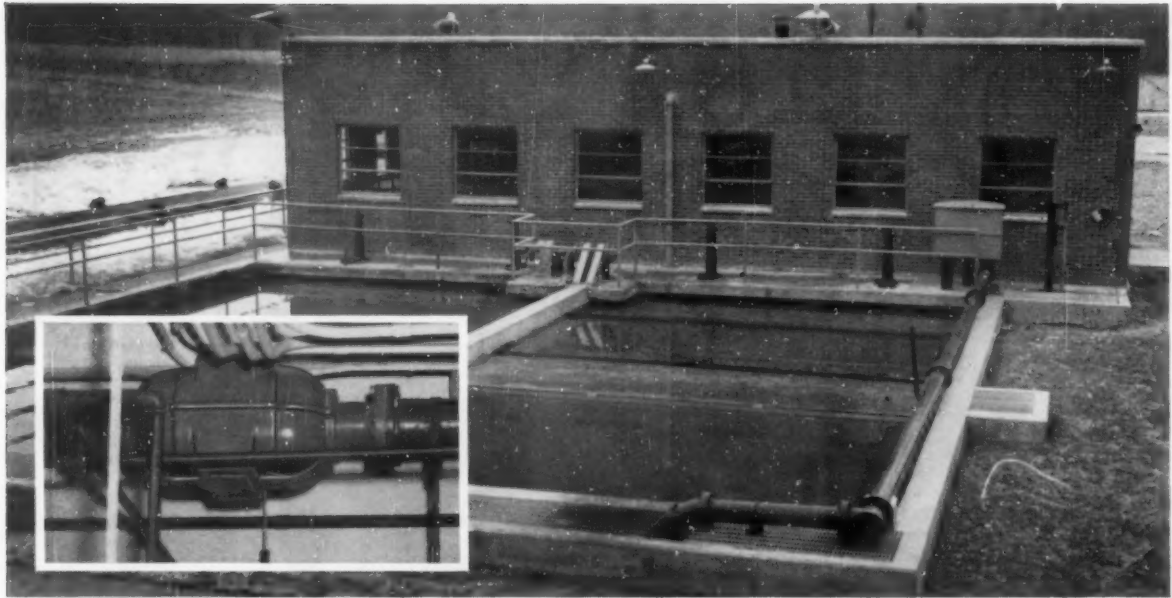


Insert plain end of pipe until it contacts gasket



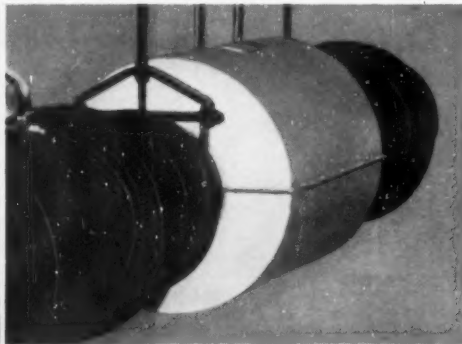
Force plain end to bottom of socket . . . the job's done!

Line Restriction



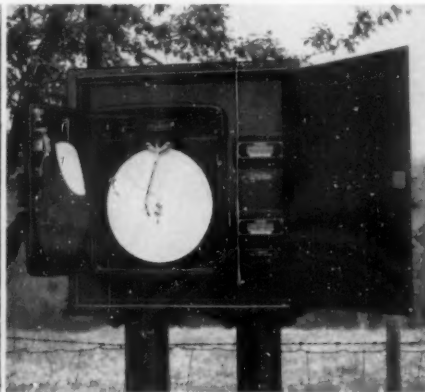
SIDNEY, OHIO

A Foxboro Magnetic Flow Meter was installed right in the return activated sludge line at Sidney's modern sewage plant. Supervisor reports it's been operating so smoothly that they haven't had to touch it.



FRAZER, MICHIGAN

12" Foxboro Magnetic Meter measures and totalizes raw sewage influent at Clinton Township treatment plant. Supervisor reports accuracy perfect — no variations — no maintenance since it was installed.



MEDFIELD, MASS.

Town of Medfield and nearby State Hospital have independent water supplies — use common storage facilities. Foxboro Magnetic Meter measures and records flow rates in both directions. Two integrators, next to recorder, keep separate running totals of both flow rates.

Problems Eliminated!

for these municipal utilities
equipped with Foxboro
Magnetic Flow Meters

Introduced three years ago, the Foxboro Magnetic Flow Meter has proved its superiority for measuring water, sewage, sludge and other treatment plant flows.

Foxboro Magnetic Meters are installed the same as a length of pipe. Measurement is linear and is transmitted by electric cable to centrally-located Dynalog* Flow Recorders. There are no line restrictions of any type. That means no added pressure drop . . . no seals, purges, meter runs, or straightening vanes.

Maintenance on the Magnetic Flow Meter is practically nil. There are no pressure taps to get plugged or frozen. No moving parts to foul.

Look over the installations on these pages. And for complete details write for Bulletin 20-14B. The Foxboro Company, 2612 Norfolk St., Foxboro, Mass., U.S.A.

*Reg. U. S. Pat. Off.

Other Progressive Communities Installing Foxboro Magnetic Flow Meters

Benton Harbor, Michigan	- raw sewage
Hayward, Calif.	- water
Pittsburgh, Pa. (Allegheny County Sanitary Authority)	- raw sewage
Covington, Ohio	- return activated sludge
Warren Township, Michigan	- raw sewage and sludge
Bloomfield Township, Michigan	- water
Seattle, Washington (Lake City Sewage Plant)	- sludge
Milwaukee, Wisconsin	- sludge
Piqua, Ohio	- sludge
Arkansas City, Kansas	- sewage

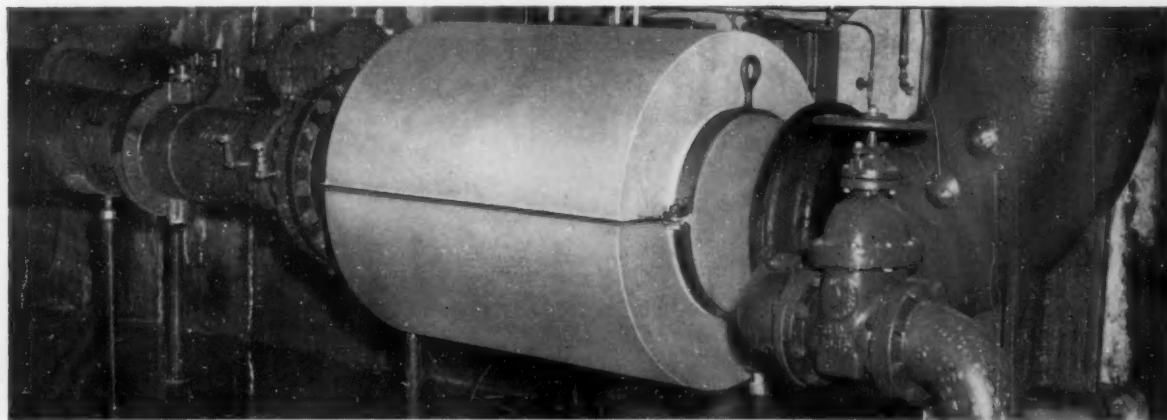
Meter sizes on these installations range
from 3 inches to 6 feet.

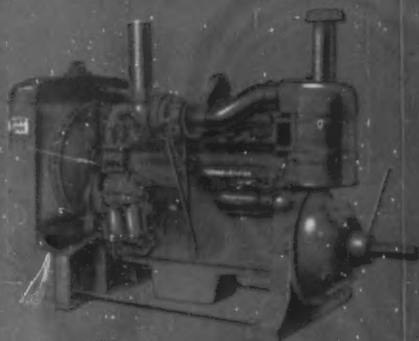
CHICAGO, ILLINOIS

This 20" Foxboro Magnetic Flow Meter was installed in the South District Filtration Plant in April, 1956. Because it has no line restrictions, plant officials knew the meter would add no more pressure drop than an equivalent length of pipe. Note how it was installed directly downstream from an elbow.

FOXBORO

REG. U.S. PAT. OFF.





UDT-1091 Turbotorque® Diesel

6-cyl.—5½ x 7; 1,091 cu. in. displ.; Eng. Max. hp—300 @ 1500 rpm; Power Unit Int. load hp—250 @ 1500 rpm



UD-1091 6-Cyl. Diesel

5½ x 7; 1,091 cu. in. displ.; Eng. Max. hp—224 @ 1500 rpm; Power Unit Int. load hp—202 @ 1500 rpm



UD-18A 6-Cyl. Diesel

4½ x 6½; 691 cu. in. displ.; Eng. Max. hp—150 @ 1600 rpm; Power Unit Int. load hp—125 @ 1600 rpm



UV-549 V-8-Cyl. Carbureted

4½ x 4½; 549 cu. in. displ.; Eng. Max. hp: Gase.—257 @ 3400 rpm; Power Unit Net hp: Gase.—209 @ 2600 rpm; LPG—200 @ 2600 rpm



UV-461 V-8-Cyl. Carbureted

4½ x 4½; 461 cu. in. displ.; Eng. Max. hp: Gase.—226 @ 3600 rpm; Power Unit Net hp: Gase.—174 @ 2600 rpm; LPG—175 @ 2600 rpm



UV-401 V-8-Cyl. Carbureted

4½ x 3½; 401 cu. in. displ.; Eng. Max. hp: Gase.—206 @ 3600 rpm; Power Unit Net hp: Gase.—160 @ 2800 rpm; LPG—160 @ 2800 rpm



U-281 4-Cyl. Carbureted

4½ x 5½; 281 cu. in. displ.; Power Unit Net hp: Gase.—67.5 @ 1800 rpm; LPG—73 @ 1800 rpm; Dist.—46.5 @ 1600 rpm



U-175 4-Cyl. Carbureted

3½ x 4½; 175 cu. in. displ.; Power Unit Net hp: Gase.—50 @ 2000 rpm; LPG—51.5 @ 2000 rpm; Dist. 35.4 @ 1800 rpm



U-123 4-Cyl. Carbureted

3½ x 4; 123 cu. in. displ.; Power Unit Net hp: Gase.—33 @ 2000 rpm; LPG—28 @ 2000 rpm; Dist. 22.8 @ 1800 rpm



UC-60 4-Cyl. Carbureted

2½ x 7½; 50 cu. in. displ.; Power Unit Net hp: Gase.—16.5 @ 2500 rpm; Nat. Gas—13.5 @ 2500 rpm



U-1091 6-Cyl. Carbureted

5½ x 7; 1,091 cu. in. displ.; Power Unit Net hp: Propane—255 @ 1600 rpm; Nat. Gas—232 @ 1600 rpm



U-501 6-Cyl. Carbureted

4½ x 5½; 501 cu. in. displ.; Basic Eng. Max. hp: Gase.—212 @ 2000 rpm; Power Unit Net hp: Gase.—133 @ 2200 rpm; LPG—126 @ 2200 rpm



U-450 6-Cyl. Carbureted

4½ x 5; 450 cu. in. displ.; Basic Eng. Max. hp: Gase.—182 @ 2000 rpm; Power Unit Net hp: Gase.—126 @ 2200 rpm; LPG—124 @ 2200 rpm



UD-525 6-Cyl. Diesel

4 1/2 x 5 1/2; 325 cu. in. displ.;
Eng. Max. hp—137 @ 2000
rpm; Power Unit Int. load hp—
115 @ 1800 rpm



UD-14A 4-Cyl. Diesel

4 1/2 x 6 1/2; 161 cu. in. displ.;
Eng. Max. hp—105 @ 1800
rpm; Power Unit Int. load hp—
76 @ 1400 rpm



UD-350 4-Cyl. Diesel

4 1/2 x 5 1/2; 350 cu. in. displ.;
Eng. Max. hp—92 @ 2000 rpm;
Power Unit Int. load hp—75 @
1800 rpm



UD-281 4-Cyl. Diesel

4 1/2 x 5 1/2; 281 cu. in. displ.;
Eng. Max. hp—68 @ 1800 rpm;
Power Unit Int. load hp—60 @
1800 rpm

21 production boosters that give you a full measure of dependable power!

Here is the complete expanded line of 21 International power units that boost your production, not your power costs. Whether diesel or carbureted—V-8, 6 or 4-cylinders—each gives you a full measure of dependable power in your new or old machines.

All 21 Internationals shown here are available in varying stages from a basic engine to a complete power unit.

The 14 International carbureted power units, ranging from 16 to over 200 net hp, can be equipped to burn either of two or more fuels—the one most economical for your use. And there's no guesswork about

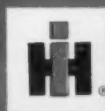
power ratings of an International on the specified fuel. Carburetion equipment is factory tested and installed.

Seven International diesels, rated from 60 to 250 net hp (300 max. hp), are outstanding for easy, all-weather starting and low consumption of No. 2 Diesel fuel. Like the carbureted models, these rugged 4-cycle units are fully sealed against life-robbing dirt and dust.

See your International Power Unit Distributor or Dealer soon. He will show you a power-packed International that will make more money for you.

International

International Harvester Company,
180 N. Michigan Ave., Chicago 1, Illinois



Construction Equipment

A COMPLETE POWER PACKAGE, Crawler and Wheel Tractors ... Self-Propelled Scrapers ... Crawler and Rubber-Tired Loaders ... Off-Highway Haulers ... Diesel and Carbureted Engines ... Motor Trucks ... Farm Tractors and Equipment.



U-372 6-Cyl. Carbureted

4 1/2 x 4 1/2; 372 cu. in. displ.;
Basic Eng. Max. hp; Gasol.—165
@ 3200 rpm; Power Unit Net
hp; Gasol.—104 @ 2200 rpm;
LPG—98 @ 2200 rpm



U-308 6-Cyl. Carbureted

3 1/2 x 4 1/2; 308 cu. in. displ.;
Basic Eng. Max. hp; Gasol.—154
@ 3600 rpm; Power Unit Net
hp; Gasol.—87.5 @ 2400 rpm;
LPG—91.2 @ 2400 rpm



U-264-6 6-Cyl. Carbureted

3 1/2 x 4 1/2; 264 cu. in. displ.;
Basic Eng. Max. hp; Gasol.—153
@ 3700 rpm; Power Unit Net
hp; Gasol.—78 @ 2400 rpm;
LPG—80.3 @ 2400 rpm



U-220 6-Cyl. Carbureted

3 1/2 x 3 1/2; 220 cu. in. displ.;
Basic Eng. Max. hp; Gasol.—112
@ 3700 rpm; Power Unit Net
hp; Gasol.—68 @ 2400 rpm;
LPG 68 @ 2400 rpm



Adams Filters installed at the new Delaware pool in the Town of Tonawanda, N. Y., give the water extra polish and beauty . . . a special invitation to enjoy the pleasures of this beautiful pool.

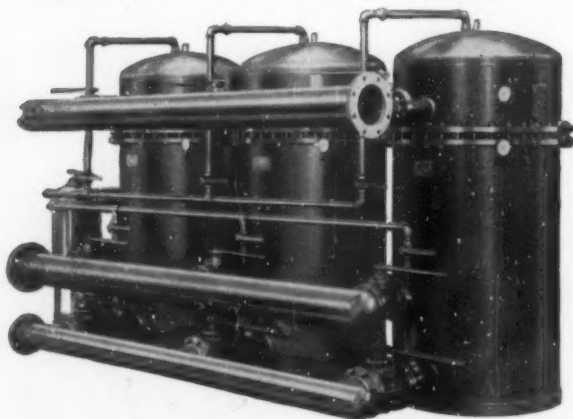
It's easy to keep your pool water Crystal Clear at Lower Costs

Hundreds of swimming pools across the nation have found that Adams filtration packages are the right answer. That's because of the advanced engineering design . . . diatomite filtration . . . permanent Poro-Stone elements . . . compact installation . . . simple operation featuring a new backwash technique.

We have a wide range of filters and delivery is prompt. You'll find the price of crystal clear water for your pool is amazingly low, so write for complete information, today.

ADAMS SPF...

TODAY'S FINEST SWIMMING POOL FILTER

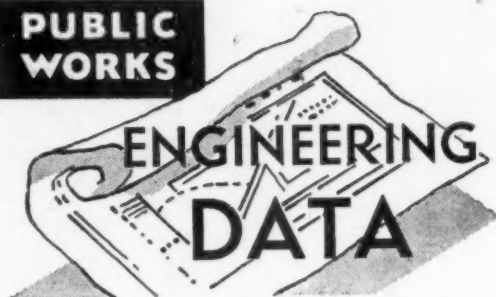


Adams SPF filters are ideal for community pools like that illustrated above. This triple SPF 169 can handle pools up to 730,000 gallons capacity.

R. P. ADAMS CO., Inc.

228 East Park Drive, Buffalo 17, N. Y.

PUBLIC WORKS



City Employee Participation in Civil Defense

A portion of the Toledo-Lucas Co., Ohio, Civil Defense plan emphasizes the responsibility of local governments in being prepared to deal with emergency situations arising from either natural disaster or war. J. W. Ault is Civil Defense Director.

In the event of a strategic evacuation, government agencies in Toledo will be moved to emergency locations, whenever this is possible without impairing the agency's normal functions. In the event of a tactical evacuation, during working hours, with little warning, employees will have specific assignments for the moving of essential records and equipment. In the case of a tactical evacuation during off hours employees will be expected to evacuate immediately. Equipment, cars and trucks, in the care of employees at their homes during the off hours, will be taken to places of safety. During off hours, government personnel will evacuate with all other persons to reception centers, where they would remain until instructed to go to their agency's emergency location to report for duty.

Cooperative CD Organization

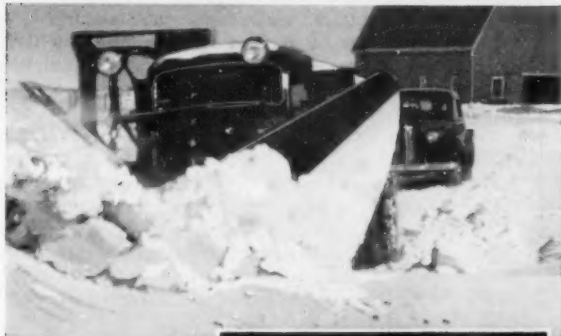
A plan for civil defense and natural disaster has been adopted by Grandville, Mich., in cooperation with other governmental units in the Grand Rapids metropolitan area. A civil defense manual has been prepared, and 200 volunteers have been recruited for various duties in case of need. Emergency communications have been provided through police and fire radio, short wave equipment and other radio systems to tie in with the Grand Rapids Police Department and the county sheriff.

Land Subsidence Resulting from Intensive Ground Water Development

Problems created by land surface subsidence in California due to intensive ground water development were reviewed at the ASCE meeting by Joseph F. Poland, of Sacramento, Research Geologist, U. S. Geological Survey, Chairman of the Inter-Agency Committee on Land Subsidence in the San Joaquin Valley, created when subsidences in the Valley had caused such serious problems in water transportation and distribution systems that a program of investigation was found necessary.

In several areas in California intensive development of ground water has been accompanied by marked subsidence believed to have been caused chiefly by withdrawal of ground water. These areas include the Santa Clara Valley in Santa Clara County; the Los Banos-Kettleman City, Tulare-Wasco and Arvin-Wheeler Ridge Maricopa areas in the San Joaquin Valley; the La Verne area east of

Snow Removal a Problem?

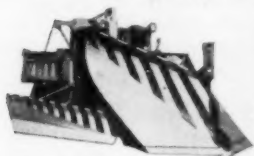


Think of **FRINK**
Specialists Since 1921 in
**SNOW PLOW
KNOW-HOW**

Since the first steel plow (a Frink) hit the highway 36 years ago, every major advance in snow plow design and performance has been a product of Frink "know-how." Today there are four basic types of Frink Sno-Plows, each with models to fit trucks from 1½ to 12 tons, and most are interchangeable on the same attachment.

Whatever your area's snow removal problem, Frink makes THE plow best equipped to do the job faster, safer and at lower operational cost for plow and truck.

Learn all the facts and reasons why so many cities, towns, counties and states specify Frink Sno-Plows. See your distributor or write to Frink for descriptive folders about these plows.



V-TYPE SNO-PLOW
—rugged powerhouse for high-speed, heavy-duty highway work; leveling wings optional.



ROLL-OVER with Taper Blade
—for airports, expressways; rotates left or right in seconds; ends "dead-heading."



ONE-WAY with Trip Blade
—for high-speed throwing and spreading, but windrows neatly at city speed.



REVERSIBLE Trip Blade
—all-purpose; plows left, right, bulldozes ahead; power reverse lever in cab.

For Snow Plow Know-How
It Pays to Think of

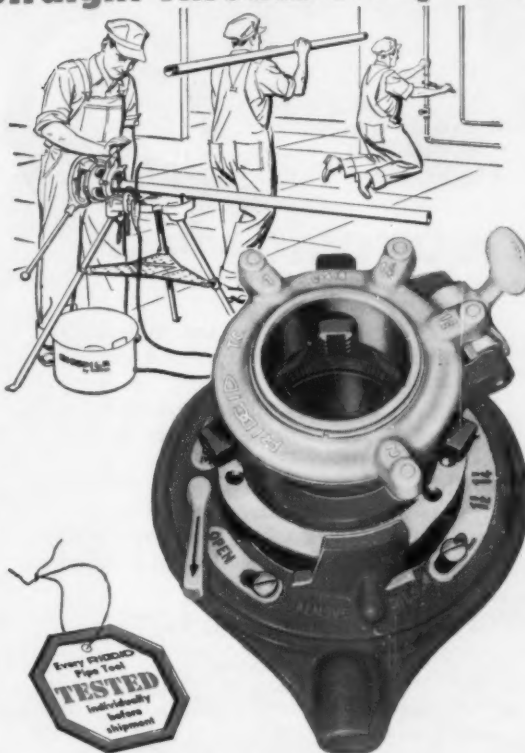
**FRINK
SNO-PLOWS**

Clayton, 1000 Islands, N. Y.
Frink Sno-Plows of Canada, Ltd., Toronto, Ontario

PUBLIC WORKS for December, 1957

RIGID

**Jam-proof 65R
Now Guarantees
Straight Threads Every Time**



**... Revolutionary New TC
(True-Centering) Workholder
centers all pipe, even over
or under size**

No more crooked threads! 65R pre-sets to size by turn of TC Workholder gauge ring —tightens by palm-of-hand push on forged cam lever. All 3 jaws close together on pipe by one mechanical action. Always straight threads, jamproof, 1" to 2" with 1 set of dies, fast size change—only 65R offers you so much for your money. Buy it at your Supply House.

P.S. The new TC workholder fits your present 65R!

The Ridge Tool Company • Elyria, Ohio, U. S. A.



As Simple As A Stopper In A Bottle -->

ALTITE JOINT

By



Advantages Of An ALTITE JOINT!

Permanently flexible and Bottle-Tight joints reduce maintenance cost to a minimum.

Longer lengths and ease of installation yield added footage laid per hour even with unskilled labor.

Simple design—no ridges or grooves in gasket seat to collect dirt and complicate cleaning the seat in wet or dry trenches.

Gasket is **REVERSIBLE**—Cannot be installed wrong.

Four Operations As Simple As Falling Off a Log—



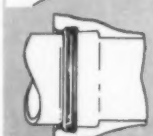
For The
Best Connection
You'll Ever Make—
Contact APCO



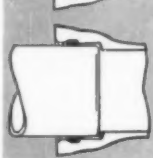
Insert Rubber gasket in bell end of pipe—you can't put it in wrong—A child can do it.



Wipe on a small amount of special lubricant—This reduces friction.



Insert plain beveled end of pipe—there are no grooves, ridges or tips on gasket to interfere with smooth insertion.



Small amount of pressure required to force plain end to bottom of socket—Your simple, time saving joint is completed.

SALES OFFICES

122 South Michigan Ave.
Chicago 3, Illinois

350 5th Avenue
New York 1, New York

950 Dierks Building
Kansas City, Missouri

18505 West Eight Mile Road
Detroit 41, Michigan

ALABAMA PIPE COMPANY

General Offices — ANNISTON, ALABAMA

Los Angeles; and, in addition, a special case, the Delta area at the confluence of the Sacramento and San Joaquin rivers. Subsidence has occurred in many other areas of ground water development in California but, in general, has not been of sufficient magnitude or of such a nature as to have created noticeable problems to date.

Subsidence problems include effects on drainage and sewerage systems, flood control channels and levees, roads and bridges, power installations, pipelines, buildings and surveying and mapping.

At Gardner Air Field in the Arvin-Wheeler Ridge Maricopa area, the Corps of Engineers spent many thousands of dollars to restore and protect utilities and buildings from subsidence amounting to several feet.

Mr. Poland said that investigative activities are directed toward measuring the extent, rate and magnitude of subsidence; causes and relative magnitude attributable to different causes; depth ranges within which subsidence is occurring; estimate of rates and amounts of subsidence that would occur in the future under assumed conditions; determination whether any part of the subsidence is reversible and, if so, the rate and amount of possible recovery.

Aerial Surveys Reduce Survey Party Work 70 Percent

In Michigan, according to a paper by C. A. Weber, Chief Engineer and J. E. Meyer, Assistant Road Engineer of Location, at the ASCE, the State Highway Dep't. has applied photogrammetry to many operations in route location, planning traffic, bridge and road design, pavement conditions and drainage studies.

Use of photogrammetry has reduced materially the time required for a route planning study while, at the same time, it has lent more authority to our recommendations for treatment. It has been estimated that where the end products of an aerial survey have been used in preliminary surveys, a reduction of upward of 70 percent of survey party time has been realized.

Specifications for Subdivision Roads in North Carolina

The proposed North Carolina county road plan specifies how sub-division roads, used "primarily for service to abutting property owners", will be handled and sets out the standards they must meet to be added to the system. As formerly practiced, subdivision roads will be paved only if the property owners to be served pay the equivalent of \$1 a square yard.

Criteria for adding subdivision roads are the right-of-way agreement; 25 per cent of the lots must be individually owned; and a minimum of three residences per tenth of a mile.

Minimum construction standards required are: 1) Grade to a minimum width of 28 feet, exclusive of side ditches; 2) minimum paved width of 20 feet; 3) a minimum base of six inches of top soil, gravel, crushed stone or equivalent base material; 4) adequate and satisfactory storm drainage; 5) grades and alignment should meet suitable engineering standards based on area and site conditions; and 6) the roadway must be paved to a minimum width with a plant-mix pavement or bituminous surface treatment to meet State Highway Commission specifications.



Philadelphia's Choice...

Davit Design
**MONOTUBE
POLES**

Mr. Harold E. Mason, Street Lighting Engineer for the City of Philadelphia, says . . . "our Market Street installation of aluminum davit-type Monotube poles, mounting 36,000 lumen mercury vapor lamps at 32 feet, provides an extremely effective and attractive lighting installation . . . ideal for our requirements."

When planning lighting modernization for *your* community, remember . . . steel or aluminum . . . round or fluted . . . davit or bracket type . . . Union Metal's half-century of experience is your guarantee of satisfaction in lighting pole quality and design.

For catalog information write The Union Metal Manufacturing Co., Canton 5, Ohio. In Canada, The Union Metal Manufacturing Co. of Canada, Ltd., Brampton, Ontario.

◀ *Union Metal aluminum poles on Philadelphia's famed Market Street . . . an investment in long life and attractive appearance.*

UNION METAL

Monotube Lighting Poles

IMAGINE THAT!

The **BALANCED** Impeller may be trimmed to suit other heads and capacities -- yet **REQUIRES NO SEPARATE COUNTERBALANCE.**



The exclusive new Mono-Vane impeller represents a major advance in the technique of non-clog pumping. This unique impeller can be trimmed to various diameters — **REQUIRES NO SEPARATE COUNTERBALANCE** because it is in dynamic and hydraulic balance — and affords a wide range of operation by merely trimming the impeller for each head and capacity requirement.

UNSURPASSED FOR HANDLING LONG STRINGY SOLIDS

IDEAL FOR ELEVATING SEWAGE — PUMPING SLUDGE — HANDLING HEAVY SETTLEABLE SOLIDS, EFFLUENT AND OTHER WASTES

TROUBLE-FREE PERFORMANCE — CONVENIENCE and LASTING ECONOMY

DISCHARGE MAY BE TURNED TO ANY POSITION — ACCESSIBLE for CLEANING

SMOOTH, QUIET OPERATION

Your Inquiries Will Command Our Prompt Attention



Type KU Aurora Vertical Mono-Vane Non-Clog Pump

AURORA
Always
PUMPS

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY

89 LOUCKS STREET • AURORA • ILLINOIS

EXPORT DEPARTMENT — Aurora, Illinois — Cable Address "NYABINT"

Post Office Department Finds Color Cuts Accidents

The color program of the Post Office Department has earned for it an extra dividend of safety. It concerns the changeover from olive-drab to red-white-and-blue paint for its motor vehicles. No longer are the olive-drab trucks merging unobtrusively with the flowing traffic. Red-white-and-blue applied to test groups of vehicles in 42 major cities, operating under similar conditions, proves that color with its attention-getting value will cut down the number of accidents.

After a pilot test in which each group operated 10 million miles, the Post Office Department has reported these results: The olive-drab fleet was involved in 849 accidents in contrast with 622 for the red-white-and-blue test groups. The "drabs" had 50 rear-end ramblings but the brightened-up fleet only 24—rather convincing proof that distance can be more quickly judged in approaching colored vehicles because of their greater visibility.

Begun in 1954, the color program is living up to predictions of Post Office safety engineers that it would make a major contribution to safety. The Post Office fleet of cars is the largest individual fleet in the United States (29,500). Their change from drab to brightness is coming about gradually, with color applied only when repainting is needed. But as the number grows, they are helping to promote safety in thousands of American communities.

Paint Used in Highway Striping

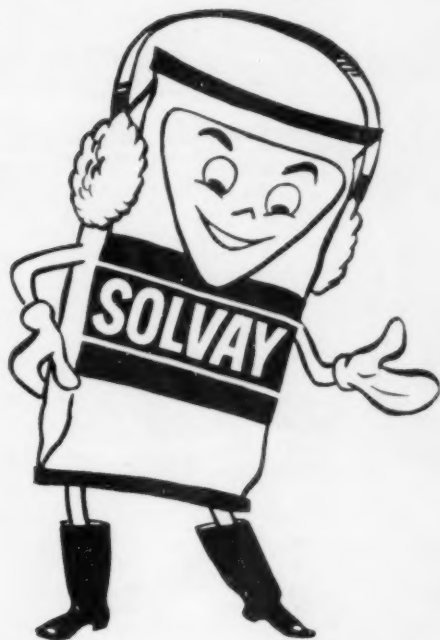
The Committee on Paints and Marking Materials of the Highway Research Board in 1955, submitted a questionnaire on traffic paints to the 48 states, 22 major cities, the District of Columbia, Puerto Rico and Hawaii.

The questionnaire was designed to develop information on the current methods of purchasing traffic paint, with particular emphasis placed on gaining information relative to specifications utilizing a road service test. The ultimate purpose of the questionnaire was to determine the principal requirements of a performance specification as indicated by the combined experiences of those agencies presently using that method of purchasing traffic paint.

The total purchases by both road and composition specifications is as follows: There was 2,917,220 gallons of white; 1,446,980 gallons of yellow; and 273,050 gallons of other type paint used by the states. In the 22 major cities checked: 221,900 gallons of white; 53,600 gallons of yellow; and 5,000 gallons of other type paint was used. The total cost of this paint amounted to \$10,708,149.

Maximum Water Pumpage and Use

The highest pumpage for any one day in Milwaukee, Wisc., in 1956 was on June 13th, 221,181,500 gallons. The maximum hourly rate of pumpage or "peak" occurred on June 13th, at 10:30 am, and was at the rate of 290,900,000 gallons per 24 hours. The maximum hourly rate of consumption was on June 12th, at 6:15 pm at the rate of 328,000,000 gallons per 24 hours. The maximum 24-hour consumption of water was 227,124,500 gallons on June 12th. The difference between consumption and pumpage is accounted for by the lowering of the water in the reservoir, the elevated storage tanks, and the ground storage tanks. The all-time pumping record for 24 hours occurred on August 16, 1955, and was 251,483,000 gallons.



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1. SOLVAY Calcium Chloride Treated Abrasives provide instant skidproofing on roads, hills. Hold fast despite strong winds, ready to spread. This method saves money treated abrasives won't freeze, are always ready to spread. This method saves money—you need less abrasives per application, fewer applications.

2. Fast Glare-ice Removal. Small quantities of SOLVAY Calcium Chloride are ideal for quick melting and loosening of thin films of

sleet or glare-ice. This tested, efficient, low-cost method is used by leading state, municipal and county highway departments. Leaves no white residue on pavements, cars.

3. Salt Users—Add small quantities of SOLVAY Calcium Chloride and get faster, more positive results than with salt alone—particularly at lower temperatures. Use 1 part calcium chloride to 3 parts salt—increasing calcium chloride ratio as temperature drops.



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84-12



"HANDIEST MACHINE I'VE EVER COME ACROSS!"

J. E. Cossiboin, Levee Board Inspector, New Orleans, La.



Mr. Cossiboin is talking about the Caterpillar No. 955 Traxcavator* owned by the Orleans Levee Board. He says: "Ours was the first No. 955 in this area and it went to work loading sand the day it came. The machine frees five men for other jobs. It loads a truck in three minutes where the job used to take 30. Also it eliminated the need for a dragline clamshell. It's the handiest machine I've ever come across."

The Levee Board finds plenty of work for its CAT* No. 955 Traxcavator. Shown here, the unit is cleaning up excess dirt after laying underground cables. In addition, it's used for 'dozing, grading, building levees, loading shell, sand and rip-rap.

Other cities have the same high opinion of the No. 955. This fast, efficient excavator-loader has a 1½-cu.-yd. bucket, 80 inches wide. A dependable 70 HP Cat Engine gives it ample digging power in tough materials. The 40-degree tilt-back of the bucket at ground level prevents spillage and adds to stability, and the 128-inch lift height makes for easy loading.

Operators like the exceptional visibility and fast-acting hydraulic controls, enabling them to speed up loading cycles. Bucket lift and tilt levers are positioned for easy one-hand operation. The exclusive Caterpillar oil clutch adds to the long work life of the machine and reduces maintenance.

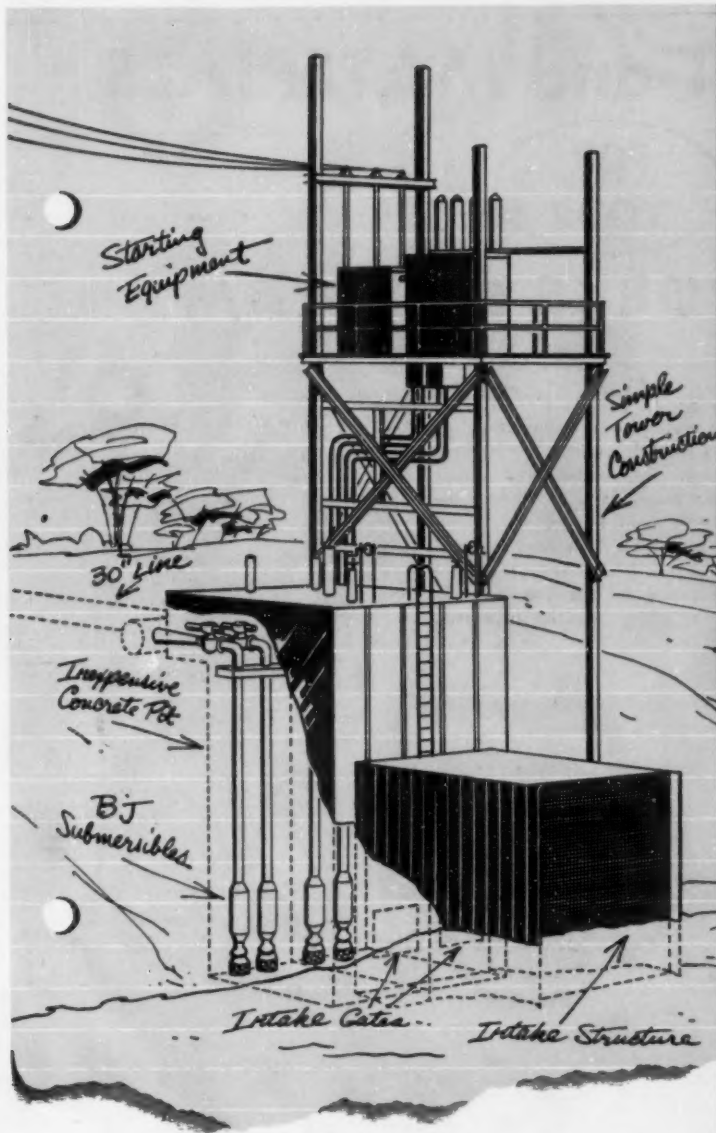
One of the Cat-built Traxcavators—No. 933 (1 yd.), No. 955 (1½ yd.) or No. 977 (2¼ yd.)—can save money for you. They're all built to do more work and harder work at lower cost. Today, ask your Caterpillar Dealer for a demonstration, and count on him for prompt, reliable service and parts you can trust.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

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St. Louis County Water Company saved money on their South County Plant installation by using Byron Jackson river intake submersibles. Four completely submerged BJ motor-pump units eliminated the need for an expensive elevated structure to house motors above flood stage. Intake and pump structure are simple concrete pit construction. The only elevated structure is a low cost platform which holds starting equipment.

These BJ Submersibles are unaffected by flood or weather conditions...are always primed and safe from vandalism. The mechanically sealed, oil-filled motor is close-coupled above the pump with all bearings inside the motor housing. No bearings are in the pump itself. Thus no bearings are exposed to silty water. Each pump delivers 3500 GPM against a 100 foot head, and is powered by a 100 HP, 1750 RPM motor. One man, at a remote panel located in the main plant a mile and a half from the river, controls the entire operation.

BYRON JACKSON PUMPS

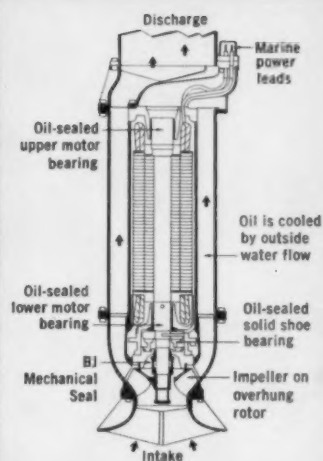
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NEW LISTINGS

Flash Drying and Incineration System

36. Bulletin FD-57 outlines the problem of sewage sludge disposal and includes color diagrams and photographs that explain how the C-E Raymond System works in heat drying and incineration. Check the reply card or write Combustion Engineering, Inc., Raymond Div., 1319 North Branch St., Chicago, Ill., for full details.

Lubricated Plug Valves For Sewage Disposal Plants

38. Advantages of acf lubricated plug valves are covered as well as operation and maintenance details in Bulletin A-5601 available from W-K-M. Division of acf Industries, Inc., P. O. Box 2117, Houston, Tex. For typical specifications covering plug valves and other information check the reply card.

Equipment For Water, Sewage and Industrial Waste Treatment



ers, bucket elevators and scum removers to mention some of the equipment.

Revere Underwater Swimming Pool Light

53. A 2-color bulletin is available describing a Revere underwater swimming pool light, as well as underwater floodlights for fountains, cascades and waterfalls. Check the reply card or write Revere Electric Mfg. Co., 6009 Broadway, Chicago 40, Ill., for your copy.

Catalog on Foundation Test Borings

62. Catalog B-7 is entitled "Subsoil Investigations for Foundations" and is available from Raymond Concrete Pile Co., 140 Cedar St., New York 6, N. Y. It explains the reason for making test borings, methods for making borings and taking soil samples. Check the reply card.

Copying Equipment For Engineering Departments

74. An 8-page, 2-color bulletin that illustrates and explains fully the xerographic copying process and the use of each piece of Xerox equipment is available from M. E. Harris, The Haloid Co., Rochester 3, N. Y. Check the reply card for full information.

An Accurate Sewage Sampler

110. Pango sewage sampler operates at all depths, is easily emptied and cleaned and reduces pumping costs. Information available from Pango Mfg. Co., 17 Lakeview Ave., Park Ridge, N. J., or check the reply card.

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

Aerial Photos, Photogrammetry, and Electronic Computation

46. Services including route locations studies, preparation of detailed construction plans, roadway plans and final measurement quantities are described in literature available from Photronix, Inc., 790 King Ave., Columbus 12, Ohio. Highway location and design problems are solved by this company. Check the reply card.

Selection and Application Handbook on Comminutors

79. Included in this handbook is a description of Worthington's comminutor line covering its features, dimensions and other information necessary for correct selection and application. Check the reply card or write Worthington Corp., Advertising and Sales Promotion Dept., Harrison, N. J., for Handbook #W-317-B17AP.

Frameless Buildings Will Simplify Your Building Problems

89. A 6-page bulletin on frameless steel buildings is available from Armo Product Information Service, Middletown, O. The buildings come in a wide range of sizes, are quickly erected and provide permanence and neat appearance. Check the reply card today.

Manual on Instrument Accessories and Supplies

96. The 60-page loose-leaf book, Catalog 500, includes specifications, part numbers and prices for more than 250 commonly furnished instrument parts and supplies. It is divided into 5 sections: Mechanical; pneumatic; electric-electronic, general, and tools and service. Check the reply card or write The Foxboro Co., Foxboro, Mass., for your copy.

Maintenance Guide For Caterpillar Tractors

104. The 24-page guide has 75 full color drawings of helpful hints for obtaining optimum service life from Caterpillar D7, D8 and D9 tractors. Check the reply card or write Advertising Divisions, Caterpillar Tractor Co., Peoria, Ill., for your copy of Bulletin No. 3295.

Topographic Maps and Photo Mosaics For Public Works Depts.

107. Examples of topographic maps and photo mosaics made from aerial photography which are saving city, county and state public works departments time and money are illustrated by American Air Surveys, Inc., 907 Penn Ave., Pittsburgh 22, Pa. Also shown are 3-dimensional plotting instruments used in preparing topographic and planimetric maps. Check the reply card.

How To Get Better Welds

120. This 60-page pocket guide gives information on metals and electrodes, 4 essentials of proper welding procedures, the fillet weld, types of joints, and causes of common welding troubles and what to do about them. Check the reply card or write Hobart Bros. Co., Troy, Ohio, for Catalog EW-201.

Joint Sealing Equipment For Highways, Streets and Airfields

123. Equipment that will handle both hot poured and cold poured rubber bearing joint sealing compounds for streets and highways is described fully in literature available from Cutler Engineering Co., 5435 W. 63rd St., Chicago 38, Ill. Check the reply card for models and specifications.

Packaged Underground Lift Station

124. Selection tables and detailed drawings of packaged underground lift stations with "Flush Kleen" sewage pumps are available in literature from Chicago Pump Co., 622 Diversey Parkway, Chicago 4, Ill. Check the reply card today.

Bell Joint Clamps For Water Main Repair

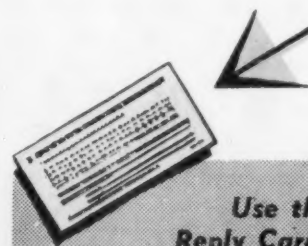
157. Clamps for repairing leaking joints in cast iron bell and spigot pipe in sizes of 4" through 30" consist of two malleable iron rings and a single ring rubber gasket. For full details write Joslyn Mfg. and Supply Co., 155 N. Wacker Drive, Chicago 6, Ill. or check the reply card.

Valve and Hydrant Construction Details

161. A 72-page catalog-type bulletin, just completed, gives detailed data on construction and application of gate valves, check valves and hydrants for water works service. Write for Bulletin 5710 from Darling Valve and Mfg. Co., Williamsport, Pa., or check the reply card.

Two-Wheel Drive Tractor Shovel

175. An illustrated, four-page brochure describes features of the Model LHM-75, all-purpose 2-wheel drive tractor shovel, obtainable from Yale and Towne Mfg. Co., Contractors Machinery Div., Batavia, N. Y. Check the reply card.



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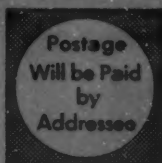
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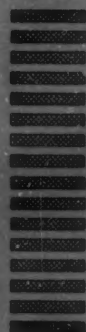
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12-1 12-2 12-3 12-4 12-5 12-6 12-7 12-8 12-9 12-10
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American Road Builders' Ass'n.

Annual Convention

Washington, D. C., Jan. 20-23

New York Section, SIWA

Annual Meeting

New York City, N. Y., Jan. 23-24

Associated Equipment Distributors

39th Annual Meeting

Chicago, Ill., Jan. 26-30

Short Course — "Environmental Health Aspects of Nuclear Reactor Operations"

R. A. Taft Sanitary Engineering Center
Cincinnati, Ohio, Jan. 27-31

Short Course — "New Techniques in Bacteriological Examination of Water"

R. A. Taft Sanitary Engineering Center
Cincinnati, Ohio, Jan. 27-31

New York Section, AWWA

New York City, N. Y., Jan. 28

National Bituminous Concrete Ass'n. Annual Meeting

Las Vegas, Nevada, Feb. 4-6

Indiana Section, AWWA

Indianapolis, Ind., Feb. 5-7

Associated General Contractors Annual Meeting

Dallas, Texas, Feb. 10

Short Course — "Detection and Control of Radioactive Pollutants in Water"

R. A. Taft Sanitary Engineering Center
Cincinnati, Ohio, Feb. 24-28

Short Course — "Advanced Training for Sanitary Engineers in Water Supply and Water Pollution"

R. A. Taft Sanitary Engineering Center
Cincinnati, Ohio, Mar. 8-14

New Jersey Section, SIWA

Atlantic City, N. J., Mar. 12-14

Short Course — "Sanitary Aspects of Nuclear Energy"

R. A. Taft Sanitary Engineering Center
Cincinnati, Ohio, Mar. 17-18

New York Section, AWWA

Schenectady, N. Y., Mar. 26-28

National AWWA

Dallas, Tex., Apr. 20-25

6th Inter-American Congress of Sanitary Engineering

San Juan, P. R., May 18-24

New England Water Works Ass'n.

Poland Spring, Maine, Sept. 14-17

Public Works Congress & Equipment Show

Kansas City, Mo., Sept. 28-Oct. 1

Michigan Section, SIWA

Detroit, Mich., Oct. 5-9

California Section, AWWA

Los Angeles, Calif., Oct. 28-31

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New Products, pages 179 to 184

12-1 12-2 12-3 12-4 12-5 12-6 12-7 12-8 12-9 12-10
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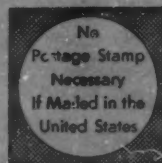
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Production really steps up when this working team moves in—the Allis-Chalmers HD-6G tractor shovel with replaceable bucket teeth and rear-mounted ripper. Here's a job-proved combination engineered by the company that pioneered modern tractor shovels for the construction industry.

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You get more work done in less time because the heavy-duty HD-6G is designed for tough jobs. With 72 net engine hp and six-truck-wheel stability, it offers performance that means efficient production every hour on the job.

These important advantages are also available on bigger Allis-Chalmers tractor shovels—the 2½-yd HD-11G, the 3-yd HD-16G, and the 4-yd HD-21G ... to help you meet the needs of your tractor shovel jobs. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*

To order these helpful booklets check the reply card opposite page 38.

NEW LISTINGS (Cont.)

Precast Prestressed Concrete Structural Elements

176. Loading tables and information on dimensions and physical properties of prestressed Leap Concrete standard building sections, including double tees, channels, and joists, given in literature available from Leap Associates, P. O. Box 1053, Lakeland, Fla. Check the reply card.

Valuable Information on International Incinerators

217. A 16-page bulletin on incinerators that have capacities up to 300 tons is available from International Incinerators Inc., Walton Building, Atlanta 3, Ga. For specifications and illustrations check the reply card today.

Drilling Machine For Concrete

221. The Truco diamond drilling machine is described in literature available from Truco Swivel Div., Wheel Trueing Tool Co., 15-3200 W. Davison Ave., Detroit 38, Mich. Unit will cut reinforced or plain concrete. Check the reply card.

Elevated Tanks and Other Storage Facilities

32. Specification sheet covering elevated tank sizes and design and illustrated brochure available from the Darby Corp., Kansas City 15, Kansas.

Meters and Instruments For Water Works

43. An attractively arranged 20-page booklet issued by Sparing Meter Co., 225 No. Temple City Blvd., El Monte, Calif. furnishes concise data on the full line of Sparing meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the reply card for your copy, or write for Bulletin 314.

Engineering Information and Water Distribution Products

49. Helpful engineering information, covering water distribution problems, is available from Mueller Company in their W-96 Water Works Catalog. The 328 page catalog features a quick reference sectional indexing arrangement for easy location and identification of the hundreds of water distribution and service products illustrated. Check the reply card and you will receive detailed information on a complete line of water works equipment.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Helpful Booklet on Carryable Centrifugal Pumps

129. A booklet prepared to give practical information that will guide you in choosing the best type of pump for your requirements is offered by the Homelite Corp. Requirements are outlined for many applications. Check the reply card for your copy. Homelite Div. of Textron Inc., 2125 Riverdale Ave., Port Chester, N. Y.

Handbook of Cast Iron Pipes and Fittings

52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use reference. Requests for this valuable publication should be accompanied by your business letterhead.

Electric Power Wherever You Need It

75. Electric power for every job—for construction, maintenance and emergencies—is always available for the owner of a convenient Homelite carryable generator. These compact gasoline engine operated units are made in a variety of sizes to suit every power requirement. Get full details by writing Homelite Div. of Textron Inc., Port Chester, N. Y., or check the reply card.

Use The Reply Card

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill., or check the reply card.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

WATER WORKS

Ball and Socket River Crossing Cast Iron Pipe

33. Literature is available describing Clow ball and socket cast iron pipe for river crossing, or any installation where full 15 degree free turning deflection is desirable. For full description and specifications, address James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.



ARPS TRENCH HOG DIGS DEEPER—7', DIGS WIDER—20", DIGS FASTER—UP TO 800' PER HOUR

HERE'S the fast, low cost way to handle most any trenching job—drainage ditches, gas lines, water mains, house service lines, septic tank laterals, foundation footings—dozens of other applications. The tractor-mounted Arps Trench Hog gives you big machine performance with a comparatively low initial investment. Has all the features to make tough jobs easy, plus the mobility only a wheel tractor can provide.

Compare the Arps Trench Hog with similar rigs—no other unit digs faster, deeper or wider. You get trenching speeds up to 800' per hour; depth capacities of 3½', 5½' and 7'; and trench widths of 6" through 20". Exclusive independent speed control for each drive wheel guarantees precise, positive control for straight line digging or curve trenching. Heavy-duty, sealed gear box keeps dust and dirt out—maintenance low. Strong, light tubular frame construction withstands the stress and impact of the toughest digging. Handy optional features include standard and tiling crumbers, one-side dirt delivery, chisel-type cutters and front-mounted angle-dozer for fast backfilling.

See how the Trench Hog can pay off on your trenching jobs. Write today for complete information to the Arps Corporation, New Holstein, Wis., Dept. PW

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HIGH DENSITY OVERLAID*

plywood signs



State's 150,000 signs are maintained by 18 two-man crews; central sign shop is in Madison.

The Traffic Services Section of the State Highway Commission of Wisconsin has experimented with every type of sign material on the market. On the basis of tests and field experience, it is now using considerable amounts of high density overlaid plywood for reflectorized highway signs. The commission cites these three reasons why:

1. Lower cost—Department figures on completed reflectorized signs show high density overlaid plywood enjoys a marked advantage over metal. A 30" overlaid plywood STOP sign for example, costs \$1.05 less than 0.081" aluminum.

2. Durability, appearance, vandal resistance—The overlay prevents checking or grain raise, extends useful life of sign. The unpainted sign back surface has a pleasing appearance, and the material seems less subject to vandalism than metal, especially by shooting.

3. Adaptability—Panels can be carried in stock in full sheets and cut to size as needed with inexpensive shop tools. Larger size plywood signs require fewer posts and framing members than comparable sheet metal signs.



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OVERLAID FIR PLYWOOD* GIVES YOU THESE ADVANTAGES:

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*OVERLAID PLYWOOD is top-quality DFPA quality-tested Exterior fir plywood (EXT-DFPA®). Two types: (1) High density overlay is hard, glossy; (2) Medium density is opaque, with texture like drawing paper.

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Please send complete application-specification data for overlaid plywood for traffic signs.

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To order these helpful booklets check the reply card opposite page 38.

Helpful Reference Catalog on Waterworks Gate Valves

146. All necessary details on Double Disc Parallel Seat Gate Valves for waterworks use are provided in the attractive 36-page bulletin issued by Ludlow Valve Mfg. Co., Inc., Troy, N. Y. Conveniently arranged design data shows all dimensions for 2" to 60" valves. Gearing, floor stands, operating devices are covered too. Get Bulletin 54W by checking the reply card.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylor gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

What You Should Know About The Centrline Process

197. The Centrline method for cement mortar lining water mains 16" thru 144" in place to stop leaks, prevent corrosion, increase carrying capacity and decrease pumping costs is fully described in a handsome booklet issued by the Centrline Corp., 140 Cedar St., New York 6, N. Y. Many illustrations and typical case histories show the operation and economics of this process. The Tate process for lining smaller mains is also covered.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Now Every Municipality Can Own a Trencher

173. The low cost of the Blackhawk Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 7 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the reply card.

All-Electric Floatless Liquid Level Control

174. Description of operating principles and application of B/W controls show the simplicity and many uses of these all-electric, floatless devices. Get latest bulletins for engineering data, diagrams of typical installations and details of component parts. Check the reply card or write B/W Controller Corp., Dept. PW, Birmingham, Mich.

For Prompt Service Use The Reply Card

Attractive Bulletin Features Large Elevated Tanks

252. In a 24-page booklet "Horton Elevated Steel Tanks of Large Capacity" Chicago Bridge & Iron Co., Chicago 4, Ill., describes the advantages of using large elevated steel tanks to provide gravity pressure in municipal water systems. Detailed information on radial-cone tanks of 500,000 to 3,000,000-gal. capacity and Hortonspherical tanks of 1,000,000 to 3,000,000 gal. is included in this really handsome bulletin.

Review of Diatomite Filtration of Water

285. A detailed review of the application of diatomite in the general field of water filtration, including uses in municipal supply and swimming pools is contained in a well-prepared 16-page bulletin. Specific applications to certain water treatment problems are also discussed. Write to the Dicalite Division, 612 So. Flower St., Los Angeles 17, Calif. for Bulletin F-552 entitled, "Diatomite Filtration of Potable Water," or check the reply card.

Efficient Underdrains for Rapid Sand Filters

239. Be sure you have engineering data on vitrified clay underdrains, efficiently designed for filtering and backwashing. Check the reply card or write F. B. Leopold Co., Inc., Dept. P.W., 227 So. Division St., Zelenople, Pa.

Valuable Booklet on Porous Diffuser Plates and Tubes

341. A helpful 16-page booklet published by the Norton Co. is a complete guide for the selection of porous media for installation in rapid sand filters and activated sludge plants. Full data are provided for the consulting engineer. Maintenance of porous media is also discussed at some length. Get Form 1246 from Norton Co., Worcester 6, Mass. by checking the reply card.

Modern Filtration of Swimming Pool Water

351. Latest data on filtration systems for swimming pools of 50,000 gallon capacity and over is presented in 24-page bulletin No. 625 by R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. Design and operating data are provided, together with material to assist you in choosing the right filter for your pool. Check the reply card.

Here's Help for Laboratory Planning

369. A comprehensive laboratory planning guide that tells the engineer and designer how to obtain maximum space economy; utilize new and present facilities; and use functional design in locating utilities, ventilation and lighting is now available from Metalab Equipment Co., Hicksville, L. I., N. Y. Complete data includes sectional and interchangeable lab equipment, furniture and accessories. Check the reply card for this valuable planning aid.

Book Tells How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet offered by Phelps Dodge Refining Co., 300 Park Ave., New York 22, N. Y. Check the reply card.



KEEGAN *Utility* PATCHER

This giant machine now makes it possible to patch pavements quicker, easier and far more economically than previous methods, and with the added advantage that the patching is a permanent job. A heating hood burns out the hole to be patched with 2,000 degrees of heat and makes the existing pavement hot. Simultaneously the machine is making hot asphalt which is spread in the hole and forms a positive bond between the pavement and the patch. The patcher needs only a two-man crew.

The Keegan Patcher cuts patching time better than 60%. Furthermore, patches are permanent regardless of time of year installed. Previously a temporary patch was required in winter, which had to be replaced in spring with a permanent patch. The Keegan giant drying unit makes year around permanent patching possible, since snow, ice or rain do not interfere with work progress.

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ENGINEER: Al Price—For Monona Village, Wis.

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PIPE: Reinforced Concrete Pipe and Tylox Rubber Gaskets supplied by Madison Concrete Pipe & Products Co., Madison, Wisconsin.

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To order these helpful booklets check the reply card opposite page 38.

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meter and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 45, Wisconsin.

V-Notch Chlorinators For Water and Sewage Plants

590. Bulletins on the Series A-711 and the Series A-712 chlorinators are available from Wallace & Tiernan Inc., Box 178, Newark, N. J. Covered in the literature are design features that include operation, installation and maintenance. Simplified flow diagrams in color are included showing the operation of the units. Class, capacities, feed ranges and electrical requirements are described in the technical data section. For your copies, check the reply card.

U. S. Tyton Joint Pipe

490. An eight page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids has been announced. The newly developed Tyton Joint is simple, sturdy and tight. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co., Birmingham 2, Ala., or check the reply card.

Bulletin Helps Specify A.W.W.A., Gate Valves

547. Double disc gate valves in 2" to 60" sizes are fully described in a 16-page bulletin which gives details on valve parts, design, materials, application of the "O" Ring Seal, operation and operating devices, directions for ordering valves and parts, dimensions of all sizes, and descriptions of eleven different methods for end connections. Valves for horizontal operation, square bottom valves, many types of gearing and gear cases, and a complete listing of special controls available are included. Get Bulletin A from Rensselaer Valve Co., Troy, N. Y. by checking the reply card.

Welded Steel Pipe from 6 to 10 3/4" Diameter

382. High grade butt welded light-weight steel pipe from 8 to 16-gauge in 20, 30 and 40-foot lengths, plain or asphalt coated, with choice of joints. Also available up to 0.188 wall. Check uses for municipal water lines, irrigation, well casings and many other applications. Self explanatory literature from Valley Mfg. Co., Valley, Nebraska.

What You Should Know About Hypochlorination

395. "Hypochlorination of Water" is the name of an informative publication issued by Olin Mathieson Chemical Corp., Industrial Chemicals Div., Baltimore 3, Md. In it there is a discussion of chlorination theory, practice and equipment; control of algae, tastes and odors; and laboratory testing.

Cleaning and Relining Water Pipe the Easy Way

397. Complete facilities for relining cast iron or steel water pipe lines in place from 4" to 144" in diameter, with both the Tate process and the Centrline process offered by Pipe Linings, Inc., 2414 E. 223rd St., Wilmington, Calif. For full information on cleaning and relining pipe with only momentary interruption of service, check the reply card.

Helpful Engineering Data on Cast Iron Pipe

422. Complete data on McWane Super-DeLavand centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long.

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Important Factors in Water Meter Selection

463. Interchangeability of parts is an important advantage that is yours when you use Trident meters. The newest parts fit your oldest Tridents so you modernize when you repair. Get full data on the entire Trident water meter line by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

Zeolite Water Softeners End Hard Water Troubles

587. A 20-page catalog on Permutit water softeners has been released by The Permutit Co., 330 West 42nd St., New York 36, N. Y. Schematic diagrams, chemical reactions, operation of the water softener and specifications are some of the sections covered. Check the reply card today.

Data on Mechanical Joint Tapping Valves and Sleeves

605. Eddy mechanical joint tapping valves and sleeves are described in literature available from Eddy Valve. Also described are repair sleeves for cast iron and asbestos cement water mains. Write Eddy Valve Company, Waterford, New York, or circle the reply card for your copy.

Simplify and Save on

Public Works Electrical Construction

710. Information and literature is available from Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa., on how you can simplify electrical details of a public works project. Westinghouse field specialists will help you plan the electrical system to fit your need. Check the reply card.

Combination Pipe-Leak Locator

744. Information on an electronic multipurpose instrument that solves both pipe location and water leak detection problems is available from The Goldak Co., 1544 W. Glenoaks Blvd., Glendale 1, Calif. Check the reply card today.

Locate Water Leaks Quicker and Easier

748. An aquaphone that requires no mechanical connection between probe and diaphragm to break or cause of trouble is described fully in literature from Aqua Survey & Instrument Co., 2012 Leslie Ave., Cincinnati 12, Ohio.

NEW Flexible QUICK REVERSE POWER DRIVE

works
sewer
stoppages
faster



Just shift the Safety Lever and rotation of rods and tool is instantly reversed. When lodged in hard stoppages, a shift to reverse quickly corkscrews the tool out of the stoppage. In boring through sand, silt, etc., the tool tends to "burrow" and an occasional reverse brings it to the top where the going is much easier. Besides speeding up the job, this new "Flexible" development reduces wear and tear on the rods as well as the machine and operator.

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DEPARTMENT OF PUBLIC WORKS
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50 BALDWIN STREET, PROVIDENCE 5, R. I.

September 24, 1956

Mr. W.O. Forman, President
Fitchburg Engineering Corporation
Fitchburg, Massachusetts

Dear Sir:

This is the second year our Fitchburg Chipper has been in service. We are very well satisfied with its performance.

It steps up our brush removal program. It consolidates the bulk, thereby lessening dumping operations. It requires minimum maintenance and manpower.

During the 1955 hurricanes and floods, we found it especially beneficial in disposing of branches and limbs of trees, thus speeding up the opening of the highways.

Very truly yours,

Edmund V. Carlos
Edmund V. Carlos, Supt.
Northwest Division

C.C. Mr. Edgar E. Maynard
Road Maintenance Engineer.

Brush disposal cost can be reduced.

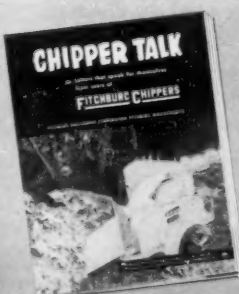
Your City will find that the Fitchburg Wood Chipper is money-saving equipment in your Highway or Park Departments. Tree trimmings are quickly reduced into load-saving wood chips. Fewer loads cut your loading and hauling expenses. Brush removal becomes a faster, simpler, less expensive operation.

Fitchburg Wood Chippers are engineered to stand hard use, to give long service without excessive maintenance costs. There is only one Wood Chipper on the market today with a One Year Guarantee...The Fitchburg Wood Chipper.

Send coupon for a copy of "Chipper Talk." Find out how a Fitchburg Wood Chipper will fit your brush disposal problems.



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To order these helpful booklets check the reply card opposite page 38.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

Water Level Controls for Sewage and Water Plants

31. Dependable float-operated pump and motorized valve controls for single or multiple pump installations are described in bulletins issued by the Water Level Controls Div., Healy-Ruff Co., 719 Hampden Ave., St. Paul 14, Minn. All units feature splash proof construction, mercury tube switches.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif.

Stop Sewage Plant Odor Complaints

137. Effective odor control for sewage treatment plants by use of "Ozone" is described in literature of Solvay Process Div., Allied Chemical & Dye Corp., 61 Broadway, New York 6, N. Y. Low cost, convenience and safety are important features.

Submersible Pumps For Municipal Use

185. A new 12-page bulletin that describes the line of BJ submersible pumps is available from Byron Jackson Pump Inc., P. O. Box 2017, Terminal Annex, Los Angeles 54, Calif. Construction and operation of the pumps are covered along with a handy selection chart that gives capacity and head performance.

Get Data Now on This Catch Basin Cleaner

198. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit, Netco Div., Clarke Wilcox Co., 118 Western Ave., Boston 34, Mass. Check the reply card.

Data Offered on Water, Sewage and Waste Treatment Equipment

263. Equipment for sewage treatment, water purification and industrial waste treatment is described in a 16-page Book No. 2440, published by Link-Belt Co., Colmar, Pa. Case histories, photographs and schematic drawings are included. Straightline and Circuline collectors, Thru-Clean and Straightline bar screens, Triton screens, flash mixers, scum breakers and other units are described.

Engineering Data on Gas Safety Equipment

343. P.F.T. Gas Safety Equipment for Controlled Digestion is the subject of an excellent 12-page bulletin issued by Pacific Flush Tank Co., Chicago 13, Ill. Full engineering data on flame traps, pressure releases, waste gas burners and related equipment is provided in convenient form. Requests for this valuable booklet must be made on business letterhead.

Valuable Catalog on Underground Pumping Stations

142. Factory-built underground pumping station with duplex sewage pumps is described fully in catalog just released by Smith & Loveless, Inc., 3427 Broadway, Kansas City, Mo. Information on operating conditions, design of sewage pump stations and force mains, charts and graphs and drawings are included. Also, full details are given on the pneumatic sewage ejector lift station which gives lower first cost, easier maintenance and greater dependability. Get all the facts by checking the reply card today.

Amvit Mechanical Jointed Clay Pipe

290. The new Amvit jointed vitrified clay pipe in sizes 4 through 24 inches with the true "built in" mechanical joint ready for immediate and easy installation is infiltration and root-proof. Offers better flow and less maintenance and permits deflection and absorbs shocks. It is furnished on all standard fittings and permits immediate backfilling and testing. For literature write to American Vitrified Products Co., National City Bank Building, Cleveland, Ohio, or check the reply card.

Use The Reply Card

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, side suction centrifugal pumps and mixed flow pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., Loucks at Dearborn, Aurora, Ill. Included is a pump selection guide.

International 6-Cylinder Carbureted Power Units

398. A graphically-illustrated 12-page catalog CR-511-G, on IHC 6 new 6-cylinder power units is available. Power and fuel consumption curves and cutaway views of component parts of the units are covered. Check the reply card or write Construction Equipment Div., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., for specifications.



The process... AERATION, OXYGENATION
Sewage and Waste Treatment

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Full-sized plant tests conducted in recent years have demonstrated the SPARJER'S superior design. In many cases they are installed on existing headers which formerly supported diffusion tubes. Bulletin 22-5-90 discusses the theory and development of SPARJERS and presents actual plant experiences and data. Write for your copy today.



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Water is your community's life blood. Water meters are universally accepted as the fairest way to charge for water . . . and the only way to keep people from wasting water.

But water meters, being fine instruments, naturally lose accuracy after years of wear. They start to give away revenue. They permit leaks and carelessness to creep back, and pumping costs go up. Eventually the water system cannot cope with the growing demand.

Worse yet, lack of proper income makes people hesitant to act, and water shortages may soon become critical.

How guard against this? Pick meters that stay accurate longer. Set up a good testing and repair program.

Walk into your meter repair shop. Talk to the men whose efforts guard your water supply. Ask them which meter gives highest sustained revenue . . . with lowest repair and depreciation costs. We sincerely believe the answer will be "Trident."

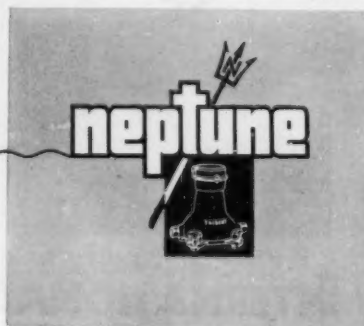
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To order these helpful booklets check the reply card opposite page 38.

**Getting Improved Sludge Dewatering
With Non-Clogging Vacuum Filters**

425. Latest information on the Koline-Sanderson "Coilfilter" which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Koline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

**New Method For Removing Grit
From Sewage and Sludge**

504. Dorr-Clone Classifier for degritting sewage is described fully in Bulletin No. 2508 available from Dorr-Oliver Inc., Barry Place, Stamford, Conn. Check the reply card for arrangements and applications.

Water, Waste and

Sewage Treatment Equipment

546. Covered in this 24-page catalog are bar screens, thickeners, collectors, aerators, gas holders, floating covers and mixers. Check the reply card or write Walker Process Equipment Inc., Aurora, Ill., for complete details on trickling filters, sludge removal and digestion. Industrial waste and recovery.

**Hydrocrane Used As A
Backhoe, Crane or Clamshell**

606. When your work calls for lifting, digging and trenching all in the same day you need a machine that converts from crane to clamshell to hoe quickly and easily. Check the reply card or write Bucyrus Erie, South Milwaukee, Wisc. for information on the Hydrocrane.

**Weir and Flume Meters For
Water, Sewage and Industrial Wastes**

612. An illustrated 8-page catalog, published by Penn Instruments, Div. of Burgess Manning Co., 1004 Haverford Ave., Philadelphia 4, Pa., describes fully transmission meters, indicating and non-indicating transmitters. It also covers new and novel metering arrangements which have not heretofore been generally used in water and sewage plant installations. Check the reply card.

**Catalogs on Diesel, Dual-Fuel,
Natural and Sewerage Gas Engines**

679. Heavy duty diesel, dual-fuel, natural and sewerage gas engines for continuous stationary service are described in literature available from Chicago Pneumatic Tool Co., 8 East 44th St., New York 17, N. Y. Check the reply card for details on 3, 4, 5, 6 and 8 cylinder models and in capacities from 120 to 3000 hp.

**Spiragester, A Combination
Clarifier and Digester**

709. A 22-page catalog is available from Lakeside Engineering Corp., 222 W. Adams, Chicago, Ill., describing the Spiragester. Check the reply card for operation of the unit, advantages, specifications, samplers and painting.

Use The Reply Card

**Catalog on Selecting Equipment
For Water-and-Waste Treatment**

718. Cross-indexed for quick, easy reference to equipment, trade names and applications, this 32-page catalog covers all major equipment in the complete Inflico line. Write for Bulletin 80 to Inflico Inc., P. O. Box 5033, Tucson, Ariz., or check the reply card.

**Sewer Capacity Speedily Restored
By "Reboring" Service**

725. An attractive brochure offered by National Power Rodding Corp., describes their mobile unit with specially designed power rodding drive and central mechanism that gets on the job fast; rebores clogged sewers and drains cleanly and safely without impeding traffic or disturbing property. National Power Rodding Corp., 1000 So. Western Ave., Chicago 12, Ill.

**Chemical to
Control Sewage Odors**

726. Cloroben is a sanitation chemical that provides control of sewage odors in treatment plants, septic tanks, cesspools and chemical toilets. Write Cloroben Chemical Corp., 115 Jacobus Ave., South Kearney, N. J., or check the reply card for applications and performance data.

STREETS AND HIGHWAYS

**How to Select Prestressed
Concrete Bridge Members**

26. Colorful folder, well illustrated, shows manufacture of "Amdek" prestressed bridge members and provides selection tables covering several AASHTO loadings. Full data from Concrete Products Div., American Marietta Co., 104 East Ontario St., Chicago 11, Ill. Check the reply card for your copy of this helpful reference bulletin.

**Levels Sidewalks and Curbs
Quickly and Easily**

29. How the Mud-Jack Method for raising concrete curb, gutter, walks and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the reply card.

**1,001 Profitable Uses
For Holmes-Owen Loader**

39. The addition of a Holmes-Owen Loader to your dump truck converts it into a complete digging and loading unit that enables one man to load, haul and dump. Illustrated folder shows how this self-loading unit with hydraulic crowding action can be a real time and labor saver for the municipality or contractor. Check the handy reply card for full data. Ernest Holmes Co., Chattanooga, Tenn.

**How to Prepare and Maintain
Roadways With Calcium Chloride**

65. "The Calcium Chloride Road," is the name of a new 24-page two-color catalog issued by the Columbia-Southern Chemical Corp., 632 Fort Duquesne Blvd., Pittsburgh 22, Pa. Included are sections on dust control, gradation, placing and mixing materials and shaping. General information on spring, summer and fall maintenance is also provided. Check the handy reply card.

THE NEW CONCEPT IN INCINERATORS

Now in operation—the great new 1000-ton INTERNATIONAL incinerator in Louisville. Proven to destroy completely all combustibles. New features, new efficiencies make this the ultimate in municipal incineration.



We are now ready to supply units up to 300 tons capacity. Get new brochure.
INTERNATIONAL INCINERATORS, Inc., Walton Bldg., Atlanta 3, Ga.

THE AIRPLACO PORTABLE RIG — consists of NUCRETOR or BONDACTOR, MIX-ELVATOR and SAND-LOADER and can be hitched onto a pickup or compressor truck for maximum portability.



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Street and Curb Repairs...
...and lowering the cost!

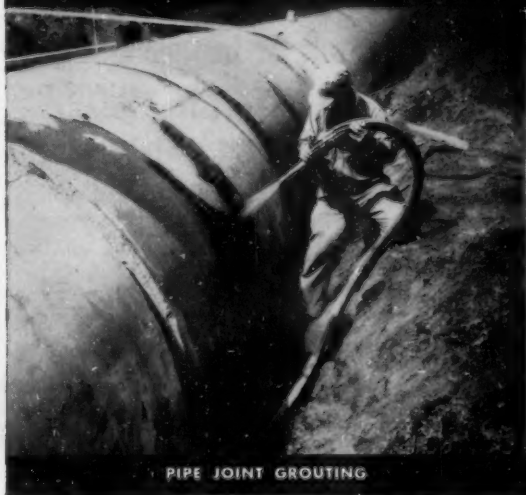
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PIPE JOINT GROUTING

Whether you are repairing curbing, streets, sidewalks, bridge abutments, reservoirs or doing any other type of concrete repair or restoration, the job will go much faster . . . much smoother . . . and at a big savings when you put the new AIRPLACO Portable Rig to work.

The AIRPLACO Portable Rig combines efficiency, portability and adaptability all into one unit. It can be moved quickly and easily from one job site to another. Operation is fast with the AIRPLACO SAND-LOADER and MIX-ELVATOR working together loading materials into the AIRPLACO BONDACTOR* or NUCRETOR*. And what could be more efficient than to gun your concrete with any one of the AIRPLACO BONDACTORS or NUCRETORS?

AIRPLACO concrete gunning equipment is available in a wide range of sizes to fit your production and job requirements from ½ to 7 cubic yards of aggregate per hour, and using air compressors with 75 to 600 CFM capacity.

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FREE CATALOG!

See your AIRPLACO distributor or write today for your complimentary catalog of AIRPLACO Concrete Gunning Equipment. This catalog will answer many of your questions about this modern, efficient equipment.



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EQUIPMENT CO.**

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MANUFACTURERS OF ADVANCED DESIGN CONCRETE GUNNING,
MIXING, GROUTING AND SANDBLASTING EQUIPMENT

To order these helpful booklets check the reply card opposite page 38.

Useful Attachments

for "Payloader" Tractor Shovels

95. Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc. Check the reply card today and full details will be sent.

How to Save Time on Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving, setups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept. FW, Warren, Ohio. Use the reply card to get your copy.

Concrete Pavement Manual Offered

171. Details of design and principles of concrete pavement construction are presented in a 78-page manual published by the Portland Cement Assn., 33 W. Grand Ave., Chicago 10, Ill. Data from many sources is summarized in convenient form to help design and construction engineers. Check the coupon for your copy.

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air. For full details check the reply card.

"A Complete Package" of Road Building Equipment

261. A new catalog describing the road widener, trench roller and base paver has been released by Blaw-Knox Co., Construction Equipment Division, Pittsburgh 38, Pa. Illustrations, specifications and operation procedures are fully covered. Check the reply card today.

How To Build Stabilized Heavy Traffic Pavements

233. A 16-page booklet published by Seaman-Andwall Corp., Milwaukee, Wis., shows how low cost, local materials may be utilized in the construction of heavy duty pavements. Many illustrations and well-written text give full instructions on materials and construction methods for subgrades, subbases and base courses. A worth-while booklet for every highway engineer. Check reply card for copy.

How to Solve the

Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem, reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass.

Bridge Concreting,

Its Problems and Solutions

390. A 16-page catalog illustrating the concreting problems involved in bridge construction is available from The Master Builders Co., Cleveland 3, Ohio. The catalog covers concreting of piers and bridge decks for highway and railway bridges, and includes discussion of hot and cold weather concreting, the use of lightweight aggregate in bridge work, and placing and finishing problems encountered in bridge work. Check the reply card for Catalog MBR-P-11.

Better Traffic Signs By Using Plyglaze Overlaid Plywood

496. Plyglaze high density overlaid plywood requires no protective paint coating when used for traffic control signs. The plyglaze surface provides an ideal base for permanent weatherproof bonding, and it will not check, blister or deteriorate when marred by bullet holes. For further information write St. Paul & Tacoma Lumber Co., Dept. P.W., Tacoma 1, Wash., or check the reply card.

Booklets on

Salt-Soil Stabilization

433. Five booklets entitled: general principles of salt-soil stabilization, plant mix and road mix procedures, crushed rock roads, stabilizing gravel roads and stabilizing shoulders are available from International Salt Co., Inc., Scranton, Pa. Check the reply card.

Information on

Photogrammetric Engineering

682. Find out how aerial surveys will advance starting time of construction jobs, conserve engineering manpower, produce fast but factual data and is economical but exact. Check the reply card or write Air Survey Corp., 1101 Lee Highway, Arlington 9, Va. today for complete information.

Use The Reply Card

Basic Facts About

Fir Plywood Diaphragms

542. General description of diaphragms and how they work, tables showing performance of fir plywood, design examples, cost and grade specifications are covered. Write to Douglas Fir Plywood Assn., Tacoma 2, Wash., or check reply card for this handy bulletin.

Survey Marking

and Identification Equipment

601. Surveyor stakes, identification caps and monument markers are described fully in literature available from Batthey Mfg. Co., Plymouth, Mich. Price schedules and descriptions are included. Check the reply card today.

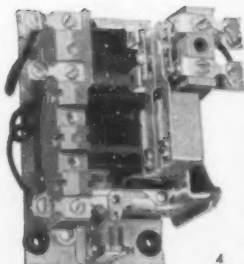
Permanent Road Patching

Anytime of the Year

755. Keegan Utility Patcher consists of a chassis, an air compressor for cutting pavement, a self feed loader which carries oil, dry material to make hot patch and binder and unit is capable of making 30 tons of hot mix per hour. Check the reply card or write Keegan Utility Patcher, 3830 Monroe Ave., Pittsford, N. Y., for full information.



all Electric FLOATLESS LIQUID LEVEL CONTROLS



The original—pioneered by B/W in 1933. No floats! No moving parts in liquid. Literature describes relays and starters, automatic starter and relay combinations, multiple pump controls, special controls and panels and many application diagrams.

Controls not affected by pressures, temperatures, acids or caustics. Remote control if desired. Ice free electrodes where necessary.

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2224 E. Maple Road, Birmingham, Mich.

FILTER SAND AND GRAVEL

Produced from an inland pit hence free from river contamination and foreign matter.

Shipment in bulk or bagged.

Many of the larger filter plants throughout the United States are equipped with our products.

PROMPT SHIPMENT

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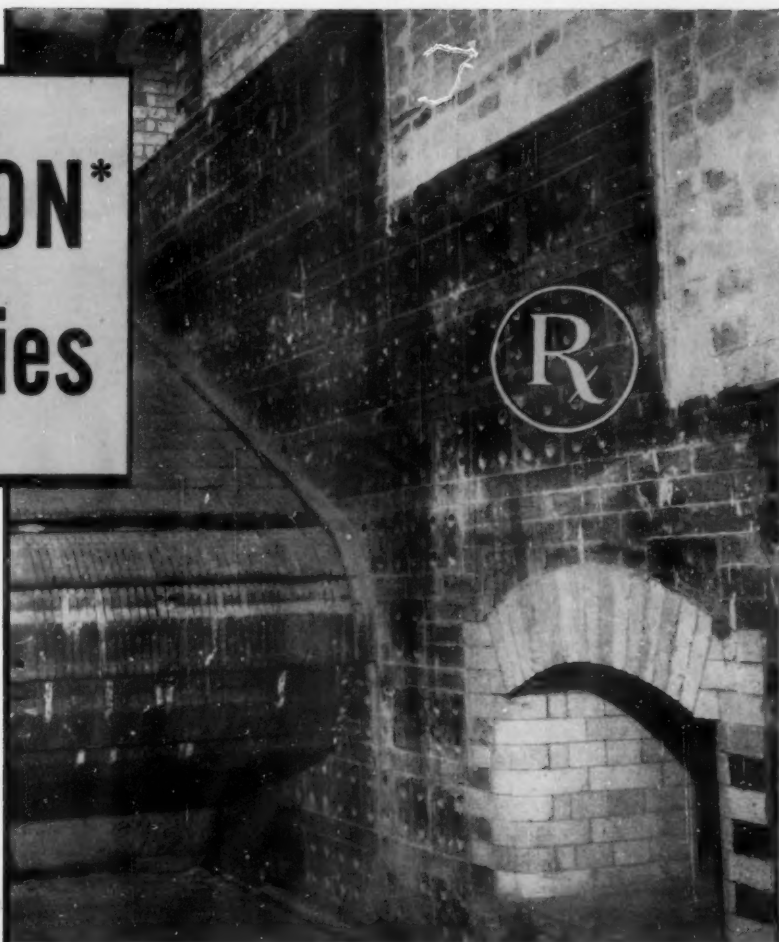
Muscataine, Iowa

P.O. Box 307 Amherst 3-2711

CRYSTOLON* Refractories

protect here!

*Approved for the
hottest zone in a
big New York City
incinerator*



CRYSTOLON Blocks and Bricks Make Up a Two-Way R. In this New York municipal incinerator plant, at the foot of East 73rd Street, Norton CRYSTOLON blocks and bricks were approved for use around the grate and up to the top of the grate line. These typical Norton R's — *engineered and prescribed refractories* — comprise the darker wall area. You can tell the air-cooled blocks by the holes and the bricks by their solid structure. Both were selected for long trouble-free service in the toughest area to protect. Refractory Contractor was W. J. Gaskell, Inc., of Brooklyn, N. Y. and General Contractors were Psaty and Fuhrman, Inc. of Manhattan. Consulting Engineers were Strobel and Salzman. The incinerator was built under the supervision of the New York City Department of Public Works for operation by the Department of Sanitation.

Here's another good example of how designers and builders of modern incinerator and power plants utilize Norton refractories for top protection of critical areas.

CRYSTOLON refractory material in incinerator linings, for example, provides great resistance to slags and abrasion from the refuse. In baffle walls it reduces erosion due to fly ash. And in all locations it withstands temperatures up to 3050° F... combines great physical strength with exceptional resistance to thermal shock, slag penetration and chemical attack

... and has many times the resistance of ordinary fire clay to erosion and corrosion.

For Your Own Operations

For details, see your Norton Representative or write to NORTON COMPANY, 231 New Bond Street, Worcester 6, Mass., for your free copy of "Norton Refractories for Heat and Power," a valuable guide to efficiency and economy in boiler settings. In Canada: Refractories Engineering & Supplies Ltd., Hamilton, Ontario.

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REFRACTORIES

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*Making better products...
to make your products better*

NORTON PRODUCTS Abrasives • Grinding
Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION Coated Abrasives
Sharpening Stones • Bakelite Tapes

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

To order these helpful booklets check the reply card opposite page 38.

CONSTRUCTION EQUIPMENT AND MATERIALS

What You Should Know About Air-Placed Concrete

67. For a detailed explanation of the principle of "gunned" or "air-placed" concrete and description of the improved Model 750 and 1250 Bondactors, be sure to get your copy of Form 553 from Air Placement Equipment Co., 1011 W. 24th St., Kansas City 8, Mo. Check the reply card today.

Principles of "Batchomatic" Plants Explained

527. The unique principles of simultaneous and fully automatic aggregate and bitumen measuring followed on Barber-Greene's 2,000, 4,000 and 6,000 lb. "Batchomatic" bituminous batch plants are explained with cut away drawings, charts and other illustrations in a 3-color bulletin offered by Barber-Greene Co., Aurora, Ill. Check the reply card.

Agent For Improving Adhesion Between Old and New Concrete

530. Thorobond liquid bonding agent for improving adhesion of new concrete to old concrete walls, floors and ceilings is described in literature available from Standard Dry Wall Products, Inc., New Eagle, Pa. Check the reply card for information on typical uses and methods of application.

Rigid Frame and Bow String Truss Steel Buildings

574. Featured in a 19-page colorful catalog are Stran-Steel's new series of steel buildings varying in widths from 32 to 80 ft. or multiples of those widths. Also described is the Stran-Satin metal wall and accessories for the buildings. Check the reply card or write Stran-Steel Corp., Detroit 29, Mich.

Sidcrane-Backfiller-Tamper, A Versatile 3-Way Machine

125. A 3-way machine, the Cleveland 80W, that is a backfiller, sidcrane and tamper is described fully in a 12-page Bulletin, No. L-102, available from The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio. Design and construction features, photographs of the machine in operation and complete dimensions and specifications are covered. Check the reply card.

Booklet Shows Design of Pre-Engineered Steel Buildings

271. Pre-engineered Butler steel buildings are available in every size, type and design to meet your building needs. In a helpful 16-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection; and many illustrations of typical uses. Use the reply card or write to Butler Mfg. Co., Kansas City, Mo.

How "Gradall" Applications Meet Your Job Needs

310. A new, profusely illustrated bulletin showing Gradall machines at work on a wide variety of municipal, county, township and highway maintenance and construction jobs has been issued by the Gradall Div., Warner & Swasey Co., Cleveland 3, Ohio. Production figures are provided to show the work output of this machine on all sorts of applications. Get your copy by checking the reply card. It's a convenient review of the many ways you could use a Gradall machine.

Advanced Tractor Design Gives Better Performance

399. The Ford Tractor offers 4-wheel stability, built-in hydraulic system, power take-off, as well as greater power, performance and economy. A complete booklet describes five tractor models in two power series, showing the latest in advanced tractor design and including many applications of equipment for saving time and money. For your copy check the reply card or write Tractor and Implement Division, Ford Motor Co., Birmingham, Mich.

Utility Tractor For Construction and Maintenance

232. Bulletin CR-1333-G describes the performance and handling ease of the International 350 utility tractor. Advantages, special features and specifications are included. Check the reply card or write Construction Equipment Div., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.

Davis Back-Hoe and Davis Loader

312. Literature is available from Massey-Harris-Ferguson, Inc., Industrial Division, 1009 S. West St., Wichita, Kans., describing the new Davis backhoe and Davis loader. The backhoe can dig at right angles and to a depth of 13 ft. and detaches in 5 minutes. Both units are available for most popular makes of tractors.

Performance and Design Features of A-C Motor Scraper

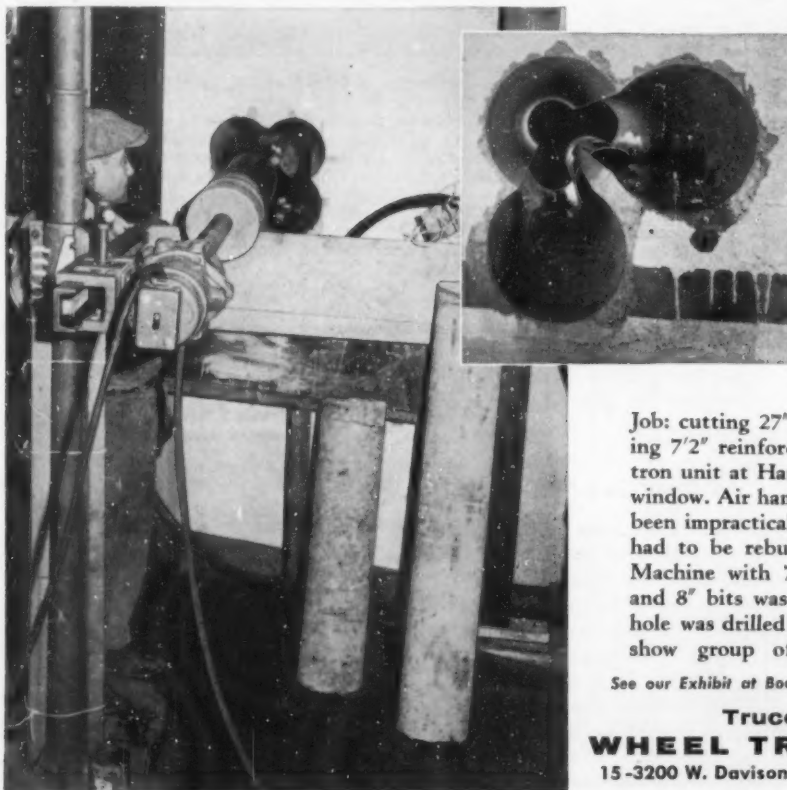
447. An 8-page illustrated catalog (MS-1226) on the Allis-Chalmers TS-160 motor scraper is available from the Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wis. Photographs, illustrations and specifications help tell the unit's design and construction story. Check the reply card.

Rotary Air Compressor For Construction and Maintenance

740. An 8-page, 2-color Bulletin, P-106B, describing the Le Roi 600 compressor is available from the Le Roi Div., Westinghouse Air Brake Co., Milwaukee, Wis. General specifications are listed and 38 photos are used to illustrate the unit. Check the reply card.

1958 Chevrolet Trucks Covered in Valuable Catalog

753. High-capacity panels, pick-ups, four-wheel drive models, dump and stake models are covered. Check the reply card or write Chevrolet Division of General Motors, Detroit 2, Mich., for information on these 6 cylinder and high-compression V8 trucks.



**DRILLING
8" HOLES
THROUGH 7-FOOT
REINFORCED
CONCRETE WALL
AT 1" PER MINUTE**

Job: cutting 27" x 10" window opening in existing 7 1/2" reinforced concrete wall housing cyclotron unit at Harvard University for observation window. Air hammers or carbide bits would have been impractical and the entire wall would have had to be rebuilt. A Truco Diamond Drilling Machine with 78 rpm heavy duty drill motor and 8" bits was used to drill eight holes. Each hole was drilled in two four-foot stages. Pictures show group of four holes from each end.

See our Exhibit at Booth 464, Plant Maintenance Show, Chicago

**Truco Swivel Division
WHEEL TRUEING TOOL CO.**
15-3200 W. Davison Ave. • Detroit 38, Michigan

LONG

LENGTH CONCRETE PIPE



Subaqueous ocean outfall line at Palm Beach, Florida. Engineer: Norman C. Schmid & Assoc., Palm Beach. Contractor: Powell Bros. Co. Inc., Ft. Lauderdale.

with **TIGHT** STEEL and RUBBER
AMSEAL JOINTS

Whether you want to keep water in or out—or both—American-Marietta long length concrete pipe with Amseal joints will do it better at less cost. In fact, the Engineer on the above job says, “The original design called for 24” diameter pipe of another type but 30” Amseal Subaqueous Pipe proved more economical.”

The longer lengths enable a contractor to install 32 feet of pipe—often 64 feet—at a time. This means less handling and joint making . . . improved flow capacity through use of fewer joints.

The “pressure proven” rubber and steel Amseal joint provides a flexible but positive water-tight seal against costly infiltration or leakage. For underwater work subaqueous connections are provided to simplify installation. Write our technical staff for assistance with your pipe problems.

Another example of
PROGRESS IN CONCRETE



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GENERAL OFFICES:
AMERICAN-MARIETTA BUILDING
101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-5600

To order these helpful booklets check the reply card opposite page 38.

Valuable Information on Concrete Testers

210. Concrete compression testers and flexure testing machines, portable concrete test-cra, and testing machines for concrete, clay and tile pipe are described fully in Bulletins from Forney's Inc., Tester Div., P. O. Box 310, New Castle, Pa. Check the reply card for complete information on models and specifications.

Power Cranes and Excavators

131. General Catalog #156 covers backhoes, clamshells, cranes, draglines, shovels and self-propelled units. Engineering features, pile drivers, power plants and specifications are also included. Check the reply card or write Schield Bantam Co., Waverly, Ia.

Help in Selecting Motor Graders

145. A 16-page catalog, No. 380, released by The Galion Iron Works & Mfg. Company, Galion, Ohio, describes the numerous construction and operation features of the Galion Model 503 Motor Grader. Optional equipment includes hydraulic shiftable mold-board, front-end scarifier, "V" and straight snow plows, rear-end bucket loader and bull-dozers. Check reply card for full data.

RECREATION

How to Equip Your Parks and Playgrounds

414. A handsome 60-page illustrated catalog showing a full line of extra heavy duty playground, pack-picnic and dressing, room equipment, plus many related items, is now available from American Playground Device Co., Anderson, Ind. Complete specifications, construction features, prices and details of labor and materials needed for installation are included. Check the reply card.



How to raise
sunken curbs
gutters
driveways
sidewalks
street slabs

KOEHRING MUD-JACK® pumps soil-cement slurry under pressure into small holes drilled through pavement. This displaces air pockets, water, or water-saturated materials — raises the concrete slab — leaves solid, permanent sub-grade. How else could you do it? Only with a Koehring Mud-Jack. Two sizes: compact, portable No. 10 for city work (illustrated) — and big No. 50 for preventive maintenance and low-cost repairs on highways.

Write to: **KOEHRING CO., Milwaukee 16, Wis.** for Mud-Jack Bulletin.

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K552 PW

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Reversible and Roll-Over Type Snow Plows for any Depth of Snow

389. Village, city, county, state and airport officials send for the latest information on Frink's two catalogues on reversible trip-blade and roll-over snow plows. Complete assembly details, specifications and operation are completely outlined. Write to Frink Sno-Plows, Inc., Clayton, Thousand Islands, New York.

How to Make Icy Surfaces Safe

455. A bulletin on how calcium chloride works in ice control and directions for its use has been made available by Wyandotte Chemicals Corp., Wyandotte, Michigan. Other uses of calcium chloride are fully outlined.

Data on the "Over-Cab" Snow Loader

728. Unit can permit single or double lane loading with trucks traveling in either direction and the 16-ft. conveyor is fully hydraulically operated. For specifications write N. P. Nelson Iron Works, Inc., 852 Bloomfield Ave., Clifton, N. J., or check the reply card.

REFUSE COLLECTION AND DISPOSAL

New Roto-Pac Features Speed Refuse Collection

50. Features of the Roto-Pac refuse collection unit, which include automatic continuous loading and packing, with increased power to provide for larger loads in the same size body, are described in bulletins issued by City Tank Corp., 53-09 97th Pl., Corona, L. I. Check the reply card now to learn how your collection problems can be eased.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 5, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Methods and Benefits of Sanitary Landfill

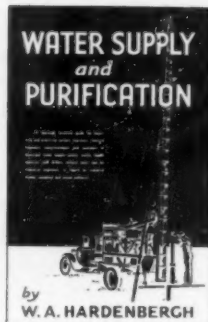
409. Information on Sanitary landfill methods, organization and necessary equipment with which to carry out the job is available from the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis. Check the reply card today.

Complete Package Dravo Incinerator Plant

384. The Dravo incinerator includes receiving pits, automatic refuse handling system, automatic combustion controls, traveling grate stoker and everything necessary for the efficient operation of the plant with minimum personnel. Write for full information to Dravo Corp., Dravo Building, Pittsburgh 22, Pa., or check the reply card.

Water Supply and Purification

by Col. W. A. Hardenbergh



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Engineering Library
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Ridgewood, New Jersey

AN authoritative yet simple treatment of the subject by one of the nation's foremost authorities, whose editorial and field work have brought him in close contact with the problems that trouble the average engineer. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods.

Among the major changes introduced in this latest edition are the following: the chapters on ground water, on filtration, and on laying pipe and maintenance lines have been almost completely rewritten; the chapters on pipe conduits and on disinfection have been revised to bring the material in them up to date and a new chapter has been added on fluoridation.

Order your copy today

Limited number of copies available in Portuguese.



from WOODBRIDGE, NEW JERSEY . . . another report on HEIL Colectomatics



"Working a tough, 6-day week— no downtime in 8 months!"

**says Superintendent
Fred Modavis**

"Our Colectomatics are completely satisfactory in every way," reports Superintendent Fred Modavis, Department of Sanitation, Woodbridge, New Jersey. "Operating cost is very low and there has been no downtime except for routine service."

You'll find owner enthusiasm like this all over the country. Municipal officials will tell you that their collection crews are generous in their praise of the Colectomatic's performance. They like the fast, safe loading—the bulldozer packing action that gets more refuse into the body on every trip.

Let your own investigation convince you. Next time you're contemplating the purchase of new equipment, ask your Heil distributor for a demonstration of the Colectomatic. You'll see for yourself how the Colectomatic (13, 16 or 20-cu-yd capacity) can improve efficiency and reduce the cost of refuse collection services in your community.

THE HEIL CO.

THESE COLECTOMATIC FEATURES SIMPLIFY REFUSE COLLECTION

- **BIGGER LOADS**
Bulldozer packing action compresses more refuse into body.
- **FAST LOADING**
Low, wide hopper sill allows two men to load side by side.
- **SIMPLIFIED SERVICING**
All lube points can be reached through doors on each side of body.
- **FAST DUMPING**
Flat floor, obstruction-free tapered body provide fast, clean dumping.
- **SAFETY**
Packing mechanism is completely enclosed. Safety door protects crew from flying debris. Load distribution on axles provides stability while dumping.
- **COMPACT BODY**
Allows better maneuvering when loading in narrow, restricted areas.
- **QUIET OPERATION**
No clanking chains, minimum truck engine acceleration while packing.

MILWAUKEE 1, WISCONSIN

Factories:

Milwaukee, Wis.; Hillside, N. J.; Lancaster, Pa.

To order these helpful booklets check the reply card opposite page 38.

How New, Larger Load-Packer Cuts Refuse Collection Costs

51. Ever increasing problems in refuse collection work include longer hauls and higher costs of labor, chassis, operation and maintenance. As a solution, Gar Wood offers Load-Packers with dual-thrust compaction that gives big capacity on shorter wheelbase, plus safe, labor-saving operation. Profusely illustrated Form W-144 tells why you should investigate Load-Packers. Check reply card or write Gar Wood Industries, Inc., Wayne, Mich.

Developments in Refuse Collection

119. The "Dempster-Dumpmaster" system for refuse collection combines the advantages of detachable containers for bulk collection, convenient front-end loading and compaction in a sealed body. Be sure to investigate the application of this system to your collection needs. Complete data offered by Dempster Bros., Knoxville 7, Tenn. Check the reply card today.

What You Should Know About Refuse Incinerators

362. Two helpful bulletins tell what you should know about low cost refuse incineration for the small community and for larger cities. Your questions on mechanical stoking, burning rates and operating problems are discussed. Get Bulletins 217 and 223 from Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y. Just check the reply card.

Check These Features On Refuse Collection Bodies

383. The Heil "Colectomatic" refuse collection unit incorporates the best features suggested by municipal operating crews, supervisors and private operators to provide easy loading, simple operating mechanism, bulldozer type packing, fast dumping and many other important advantages. Available in 16 and 20 cu. yd. capacities. Check them all by getting attractive Bulletin BFI-54103 from The Heil Co., 3044 W. Montana St., Milwaukee 1, Wis. Your copy is ready—just check the reply card.

Engineering Data on Incinerator Design

118. A comprehensive bulletin which provides full engineering data on municipal refuse incineration is offered by Pittsburgh-Des Moines Steel Co., 3422 Neville Island, Pittsburgh, Pa. This 20-page booklet shows basic requirements for satisfactory incineration, gives incinerator design details and describes modern mechanical stoking, construction features and modernization of existing plants. Get your copy by checking the reply card.

STREET LIGHTING AND TRAFFIC CONTROL

All-Aluminum Supports For Traffic Control Programs

64. Design and specifications of all-aluminum supports for traffic control signals and signs are covered in a 20-page catalog just released by Pfaff & Kendall, 84 Foundry St., Newark 5, N. J. Type of supports described are as follows: Trombone type standards for horizontal signal over roadway; mast-arm type standards for vertical signals; truss type span for lane traffic signals; structural truss type span for horizontal signs over roadway; pedestals and sign supports. Check the reply card for your copy.

Mercury Vapor Street Lighting

193. This bulletin entitled "Mercury Street Lighting" covers the use of mercury vapor luminaires in lighting streets and highways—residential and business, highways and turnpikes. Technical data on photometric performance, distribution of initial candlepower and dimension diagrams of the various units are included. Check the reply card or write News Bureau, General Electric, Schenectady 5, N. Y. for Bulletin GEC-1403.

Trafficcones For Positive Traffic Control

240. Trafficcones and adapters for a complete Trafficcone System are covered in literature available from Interstate Rubber Products Corp., 908 Avila St., Los Angeles 12, Calif. The cones are made of flexible natural rubber paint guaranteed not to discolor and built to withstand abuse.

Monotube Overhead Sign Supports For Highway Marking

567. Monotube overhead sign supports for freeways, turnpikes, expressways and general highway use are described fully in catalog available from the Union Metal Mfg. Co., Canton 5, Ohio. The catalog describes in detail both double and single post designs, including assembly and installation details, dimensional data and some of the possible variations. Plenty of photographs and drawings are included. Check the reply card for your copy today.

PR System of Coordinated Traffic Control

733. Literature is available on all-electronic equipment for coordinated traffic signal operation from Automatic Signal Div., Eastern Industries, Inc., Norwalk, Conn. System is usable for both arterial and grid network signal systems. Check the reply card.

BUSINESS ADMINISTRATION

Make Blueprint Filing Easier and More Efficient

717. A blue print rack for engineering departments that is made of steel and is equipped with 12 plan holders is described in literature available from Momar Industries, 4323 West 32nd St., Chicago 23, Ill. Check the reply card for price list and the advantages of this easy to move and complete unit.

Many Courses Available From Correspondence School

756. All the varied branches of civil engineering are subjects of courses offered by the International Correspondence Schools, Scranton, Pa. The many courses are outlined completely in catalog available.

What is Incineration?

A definition recently arrived at by an engineering society committee states:

"Incineration is the disposal of waste and/or refuse by combustion for the purpose of obtaining an inoffensive residue and effluent with a reduction in bulk".

The word "inoffensive" means compliance with today's strict air and stream pollution control codes.

Whatever your disposal problem, Nichols incineration specialists are ready to engineer and deliver an incinerator plant designed especially for your requirements—with emphasis on "inoffensive" residue and effluent.

Contact the Nichols office nearest you.

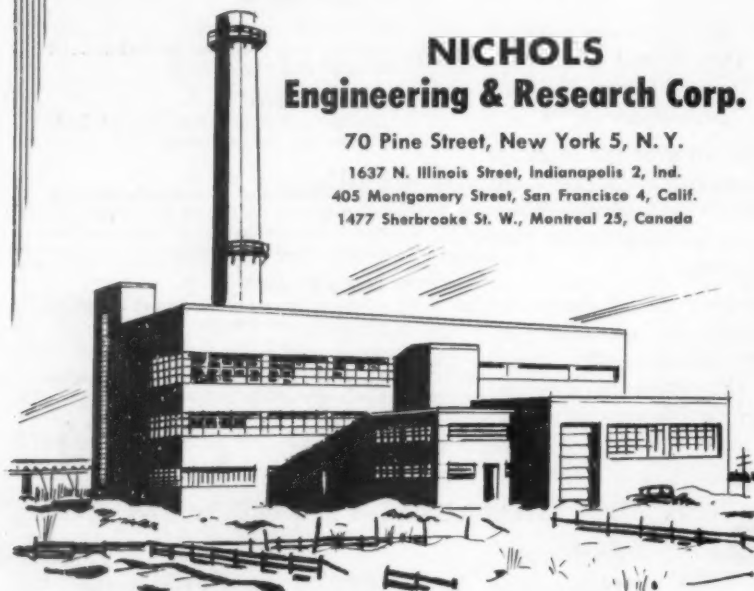
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70 Pine Street, New York 5, N. Y.

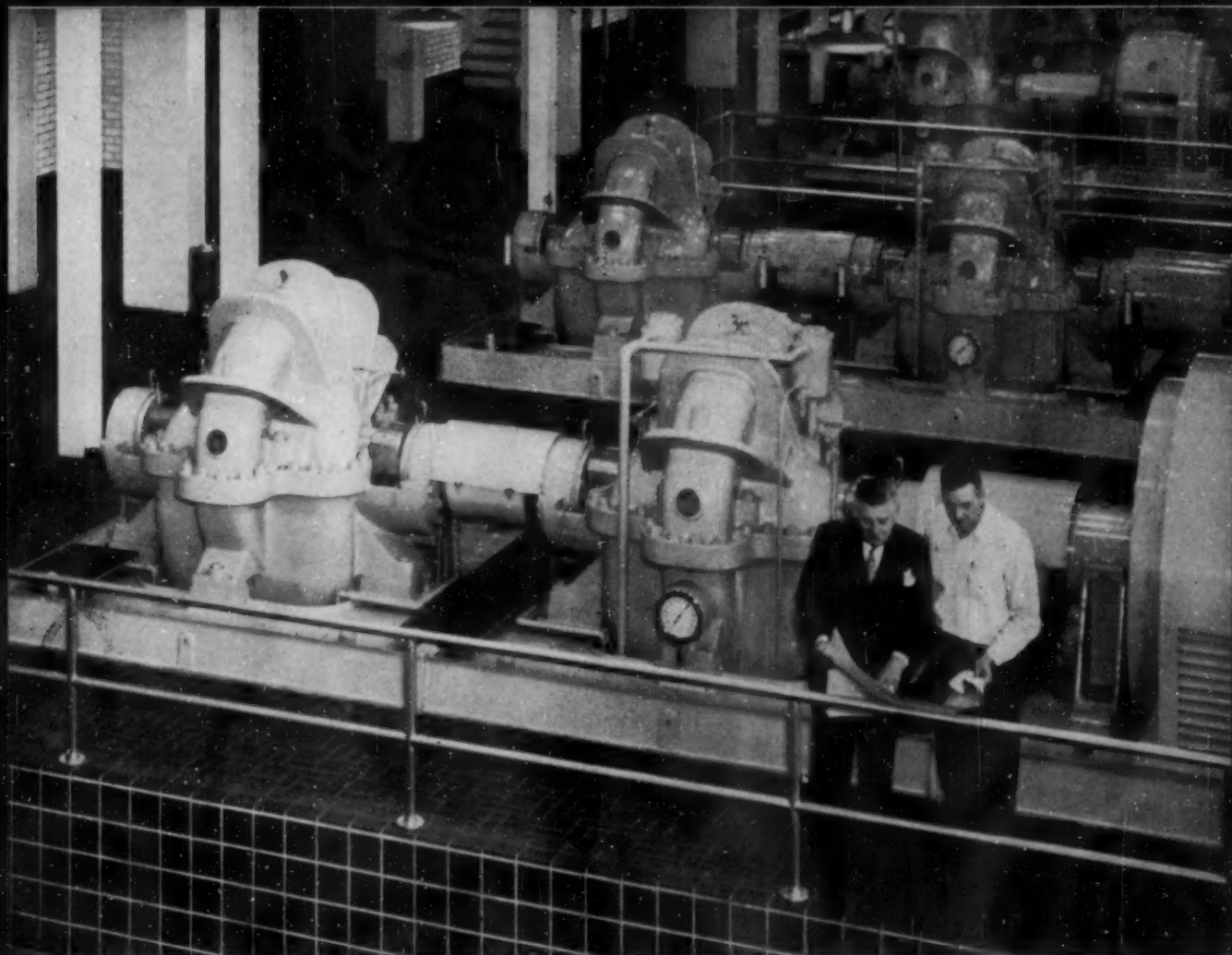
1637 N. Illinois Street, Indianapolis 2, Ind.

405 Montgomery Street, San Francisco 4, Calif.

1477 Sherbrooke St. W., Montreal 25, Canada

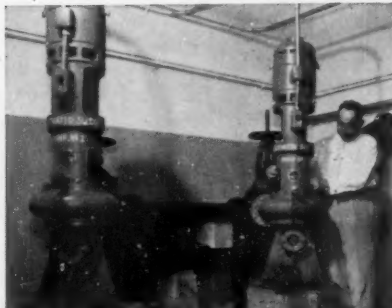


Earle Vinnedge, Worthington Corp., and Lou Motz, Pumping Station Supervisor, Cincinnati Main Pumping Station, check performance of Worthington pumps installed in 1957. Earle represented one contact—one responsibility for the pumping equipment. We believe you too will find it advantageous to deal with the Man from Worthington. Cincinnati Water Works. Main Pumping Station. Consultants: Black and Veatch, Kansas City, Mo.



.5 MGD TO 500 MGD

Any size, you have more to choose from with Worthington



These Freflo sewage pumps typify hundreds of Worthington equipped treatment plants.

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An unbiased recommendation. Because Worthington makes all types of pumps and drives and a complete line of engines, compressors, comminutors and auxiliary equipment, you get equipment recommendations based on a broad look at all ways of doing the job. You have a choice, for example, of either vertical or horizontal centrifugal pumps. In many other ways — some small, some major — the Worthington line lets you tailor the equipment to the specific requirements of your plant.

Unit responsibility. You do business with one company—eliminating delays and inconvenience that can occur when you are forced to coordinate the efforts of several suppliers. Unit responsibility by Worthington saves you time and money.

Small or large, you'll do better by consulting Worthington. For more information call your nearest Worthington District Office. Or write to Section W-71, Worthington Corporation, Harrison, N. J.

WORTHINGTON





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New HOLMES-OWEN TRUCK LOADER

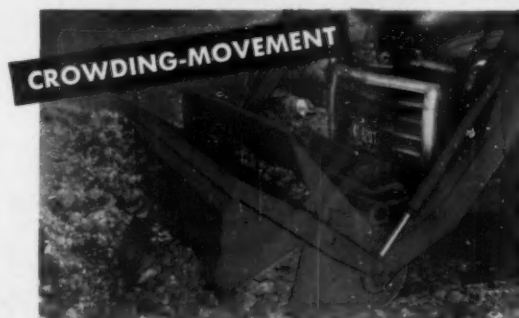
The Only LOAD-and-HAUL
Unit with **ELBOW-ACTION**

The one factor which gives the HOLMES-OWEN Loader such rugged strength and flexibility of operation is the "Elbow-Action" provided in its lifting arms. Through this exclusive feature, the upward and forward cycle of the bucket can be very accurately controlled, thus permitting a "Crowding-Movement" not possible with other type truck loaders. The $\frac{3}{4}$ yard bucket is activated by powerful, double hydraulic cylinders. All controls are conveniently located in the truck cab, which enables the driver to handle a wide variety of jobs such as: light digging, grading and loading, without additional manpower or equipment.

There are 3 types of loaders, each adaptable to different kinds of work—the *Standard loader* with a scoop-type bucket is for self-loading and hauling. When equipped with a *Forward-Type bucket*, the unit is capable of loading other trucks, as well as itself. The *Claw-Type bucket* works either forward or backward, but is faster and more efficient since it allows the operators to pick up about 25% more material per bucket. Either type loader can be used with a standard dump truck body and may be installed on most any 2, 2½ or 3 ton truck. Write factory TODAY for details.



Arms flexed in "Elbow-Action". Hydraulic power forces arms forward and upward permitting loading from a standstill without using traction of truck to fill bucket.



Claw-Type bucket showing downward spading action of jaws as bucket engages material in "Crowding-Movement" necessary for loading.



Forward-Tipping bucket permits use in dual capacity—for self-loading as independent working unit or as loader for other trucks.

"Elbow-Action" assures complete inversion and emptying of bucket without spillage or the need for a cab protector.

ERNEST HOLMES COMPANY - CHATTANOOGA 7, TENN.

JEFFREY Collectors remove mill scale...greatly lengthen life of rolling mill bearings



*Jeffrey mill scale collectors at
Pollak Steel Company,
Marion, Ohio.*

Eighty-five tons of scale and grease removed in six months! That's the remarkable record these Jeffrey collectors have established...putting nearly 3 million gallons of process water back to work daily at this rolling mill.

Bearing life on their rolling mill has been increased enormously, according to the plant's operating men. There's no abrasive scale in the water to cause excessive wear on bearings.

Jeffrey sanitation engineers will help solve your water conservation or sewage treatment problems—a complete system or individual units. The Jeffrey Manufacturing Company, 947 North Fourth Street, Columbus 16, Ohio.

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EQUIPMENT...TRANSMISSION MACHINERY
...CONTRACT MANUFACTURING





One of a series of reports to Traffic Engineers and Highway Officials on

BETTER SIGN MATERIALS

FACTS ABOUT PLYGLAZE® AND PLYALOY® OVERLAID PLYWOOD

- **IDAHO LOWERS SIGN COSTS;** PlyGlaze Case History
- **VANDALISM TESTS;** Racking and Bending Damage
- **COLORFAST OVERLAY;** Green PlyGlaze Now Available



report on Idaho signs

One of the first (1950) large-scale users of high-density overlaid plywood traffic signs, the State of Idaho is now using black PlyGlaze for black background directional and informational signs. This new method should make a more durable and uniformly better looking sign, and also substantially lower costs by eliminating painting.

The Traffic Engineering Division of the Department of Highways of Idaho expects the new black signs will have legibility equal to or better than similar signs which were previously painted. The plastic-like overlay is more durable than paint and forms a better base for reflective letters. Idaho will continue to use natural (amber color) high-density plywood for fully reflectorized signs over 2' x 2' and for smaller signs.

Before switching to overlaid plywood, Idaho had had trouble with ordinary plywood or wood for permanent signs, due to its rugged climate with temperatures ranging from 125° above to 25° below zero. The high-density panels prevented grain raise and checking, a major source of trouble, and also halted progressive deterioration after damage from vandals or accidents. In seven years not a single overlaid plywood sign has failed due to weathering.

As far as costs are concerned, Idaho has found overlaid plywood ranks between steel and aluminum. A reflectorized 4' x 8' sign, for example, of PlyGlaze runs about 13% less than aluminum and about 5½% more than steel. When replacement and maintenance costs are considered, overlaid plywood even costs less than steel for some types of installations. The new unpainted black signs

should put it in an even more favorable position costwise.

Idaho secured a completely new modern sign shop in Boise in 1952. Equipped with many of the latest and best facilities, the new shop has been an important factor in further improving the high quality at low cost sign production efficiency which has long ranked Idaho as one of the leaders in the highway sign field.

The signing program is under the direction of Ellis Mathes, State Traffic Engineer, and Pete Quarles, Traffic Technician; W. B. Woods is State Sign Shop Superintendent.

DFPA vandalism tests

One of the big factors in sign mortality is damage from racking or bending caused accidentally by impact with passing vehicles or deliberately by vandals.

This type of damage was studied by Douglas Fir Plywood Association as one series of tests conducted to determine the relative durability (abuse resistance) of various sign base materials. Standard 24" reflectorized signs were checked for stiffness in an Olsen testing machine and for rigidity by hand racking.



The results (see chart) show overlaid plywood markedly superior to metal in both respects. Incidentally, this extra strength and rigidity (made possible by its solid cross laminated base) is why large PlyAloy or PlyGlaze signs generally need no supporting framework and fewer posts than comparable metal signs.

TEST MATERIAL	BENDS UNDER 175 lb. LOAD*	HAND RACKING
¾" OVERLAID PLYWOOD	¾"	Could not be bent. Severe racking loosened from post.
ALUMINUM 6061-T6 (.081")	6¾"	Easily bent. Due to flexibility couldn't be loosened.
16 Gauge STEEL	3½"	Easily bent. Could be wrapped around post.

*Amount corners were bent down in Olsen Testing Machine

green background signs

PlyGlaze with a color-fast forest green overlay is now available for unpainted green background signs with reflectorized or painted legends. The new color was developed primarily to meet requirements of the interstate signing system which calls for a white legend on a green or black background. The overlay requires no paint either for protection or as a preliminary for reflective sheeting. Mail coupon for samples.

description, specifications

PLYGLAZE:* Exterior plywood with high-density phenolic resin-fiber overlay fused to both sides of panel. Overlay is hard, glossy, abrasion resistant, need not be painted. Ideal base for reflective sheeting. Colors: amber, black, green.

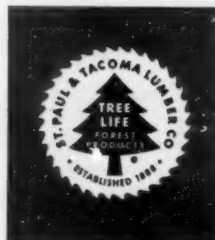
Specification: PlyGlaze (B-B) 60/60 High Density, mfg. by St. Paul & Tacoma Lumber Co.

PLYALOY:* Exterior plywood with smooth, durable medium-density overlay on one or both faces. Overlay is ideal paint base; has texture similar to expensive drawing paper. Color: buff.

Specification: PlyAloy Medium Density, faced both sides (F2S) ... or faced one side (F1S) ... manufactured by St. Paul & Tacoma Lumber Co.

*Both PlyGlaze and PlyAloy meet U.S. Commercial Standards, are DFPA-Inspected. Available in standard plywood sizes, thicknesses.

FOR MORE INFORMATION (detailed specifications, application data, etc.), please mail coupon



ST. PAUL & TACOMA LUMBER CO., DEPT. PW, TACOMA 1, WASH.
Subsidiary of St. Regis Paper Company

Send literature and/or material checked:

- ☐ Specification & Application Data
- ☐ Samples and Current Prices
- ☐ Complete Vandalism Report

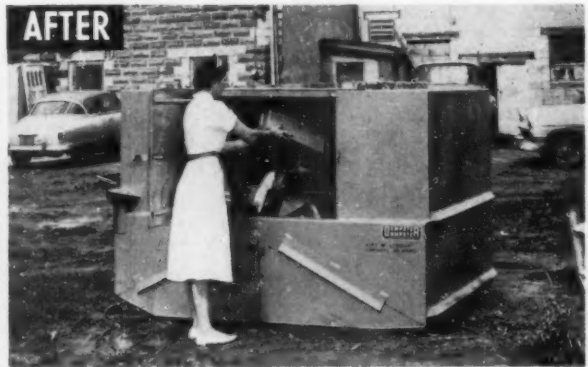
Name _____

Firm or Dept. _____

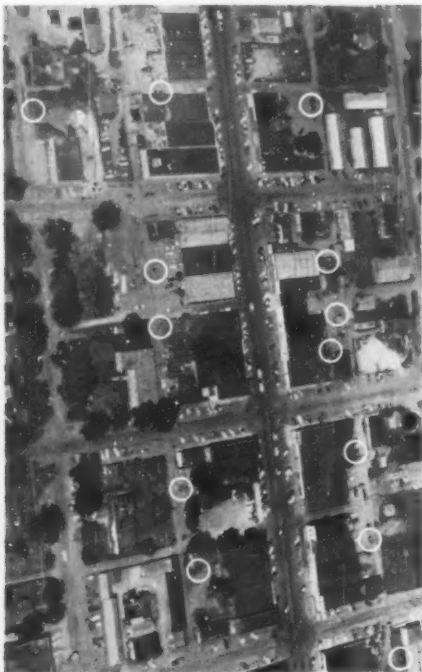
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One-Man, One-Truck Dempster-Dumpster System Handles Downtown Rubbish Collection

"Lindsay never looked like this before!" "Finest improvement in the history of our city!" These are typical of the many comments made by proud citizens, Mayor W. D. Stephens and other officials after the Dempster-Dumpster System was recently installed in progressive Lindsay, Oklahoma.

From coast to coast, progressive, cost-conscious municipalities are turning to Dempster-Dumpster containers for clean-ups of business districts, apartment or housing

projects and even local industrial plants. Once rubbish is placed in the clean, big-capacity containers, rats and flies can't get in . . . odors can't get out . . . wind can't scatter it. Best of all, with one truck-mounted Dempster-Dumpster and one driver, you can save up to 25 cents per cubic yard on collection costs. The average installation pays for itself in less than 36 months. Write today for a free survey; there is no obligation.

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DEMPSTER BROTHERS, Knoxville 17, Tenn. Dept. PW-12





Exterior view, showing ash tunnel entrance at right center.



Truck ramp and spacious tipping floor outside storage bin.

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**375 TONS
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INCINERATION by PITTSBURGH -DES MOINES

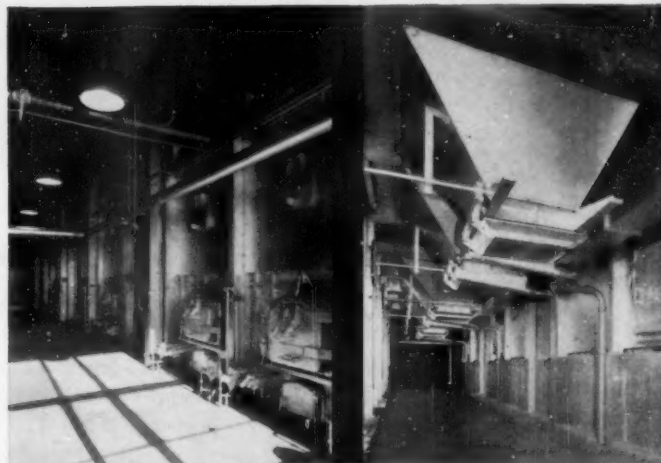
This compact, modern facility provides Omaha with the most advanced features in community refuse disposal at low comparative cost. Thanks to Pittsburgh-Des Moines mechanical stoking, high capacity is obtained with minimum manpower. Complete high-temperature incineration of all combustible material assures freedom from odor, fumes and dirt. Write for 24-page Bulletin 601, detailing the various PDM Incineration Plant types and advantages.

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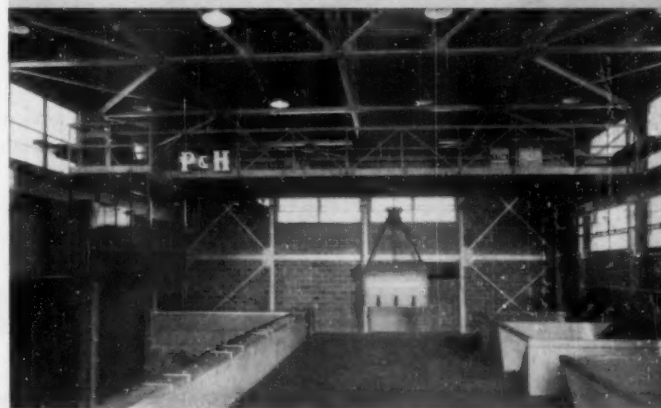
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Stoking floor, showing hydraulic stoker controls.

Ash hoppers in drive-through tunnel.



Charging floor, storage bin and crane.



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LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Piling the Snow High May be Risky Business

Just a slip in the dark, but to Clara Mills it was no lark. In *Mills v. City of Springfield*, 142 N. E. (2d) 859, an Ohio case decided April 28, 1956, Clara Mills sought to recover for injuries caused by slipping on a ridge of ice in the City street.

The evidence submitted by the plaintiff indicated that an unusually heavy precipitation of snow between Dec. 14 and 20 (about 14 inches) had necessitated the use of snow plows by the City of Springfield on its principal streets. The operation of the snow plows resulted in ridges of snow from 2 to 3 feet in height on each side of Limestone Street within the street, but alongside the curbs. At the intersection of Trenton Place and Limestone Street, in the residential district, this ridge of snow extended across the entrance of Trenton Place into Limestone Street. At 7:30 P.M. on the evening of Dec. 28, the plaintiff alighted from a city bus at the northeast corner of this intersection, and attempted to enter her home, which was at the southwest corner. It was dark, and the street light maintained by the Ohio Edison Company was out, and had been out for at least the previous night. There was a dim light, reflected from the lights of the bus. Plaintiff was aware of the ridge, having observed it that morning on the way to work, and on previous days. Nevertheless, in trying to cross the ridge, which had become icy, she slipped and was injured.

In the trial court, the jury awarded the plaintiff damages, because the City had maintained a nuisance through negligently failing to remove the ridge of ice and snow. On appeal, the City contended that, as a matter of law, it had not been negligent and had not maintained any nuisance.

Evidence of the temperatures

during the days before the incident appeared to indicate that thawing and subsequent freezing had probably taken place on the evening of Dec. 25, following a rainfall. The Court of Appeals therefore held that the lapse of time was insufficient as a matter of law to constitute constructive notice to the city that an ice hazard existed for pedestrians at this place. According to the court, the existence of a hazardous accumulation of snow and ice for several days in a downtown area might be sufficient to afford a presumption of constructive notice, but that is not so as to residential streets. The reason for this distinction seems to be based on the idea that it is not feasible or reasonably practicable for the city to keep track of such conditions everywhere in the City, but only where there is a great deal of pedestrian traffic.

The Appellate Court, in a 2-1 decision, held that the City was not liable, and that the plaintiff by coming home after dark had simply assumed the risk of such an accident. The dissenting judge couldn't see why she had assumed this risk simply by coming home after dark. In his opinion, the jury's verdict of negligence by the City should have been sustained.

Thus, while the City of Springfield didn't have to pay in this particular instance, we can see that letting snow piles in the street turn to ice is a risky business. The decision in the present case was pretty slippery, and we are in the dark as to what the next court will do with a similar situation.

There's Many a Slip

Not only did Clara Mills slip on ice (in the previous case), but so did Elroy F. Mueller, in *Mueller v. City of Milwaukee*, 83 N. W. (2d) 735, a Wisconsin case decided June 4, 1957. The difference, however, is that Mueller recovered damages from the City for his injuries.

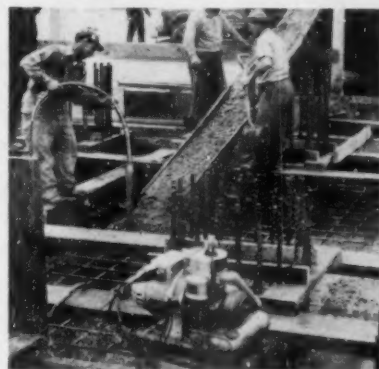
Full Line of Carryable Construction Equipment Now Offered by Homelite



Carryable Diaphragm Pump . . . This self-priming, 120 pound diaphragm pump will handle water in the thickest sand, muck, or mud. Capacity: 5,000 g.p.h. Size: 3". Complete line of centrifugal pumps are also available in sizes from 1½" to 3".



Chain Saws For Every Job . . . Now you can choose from a full line of lightweight, powerful Homelite chain saws. From 3½ to 7 horsepower . . . 19 to 29 pounds. Brush cutting and clearing attachments are available to handle all your cutting jobs.



One-Man Electric Vibrator . . . It takes only one man to place concrete with powerful, Homelite high-cycle or universal electric concrete vibrators. Carryable Homelite generator provides power for high-cycle vibrators and 110 volt DC for all universal vibrators, tools and floodlights.

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When the Montrose Improvement District in Westchester County, New York, decided to install a filtration plant to handle Catskill Aqueduct water (turbidity exceeding 10 ppm more than 50% of the time) they were faced with serious difficulties in respect to plant location. Available space was severely restricted, and the matter was further complicated by foundation and ground water problems.

Diatomite filtration solved all the site difficulties,

and allowed the filters and all mechanical equipment to be housed in one small two-story building which still provides adequate space for the addition of filters and pumps to double the present capacity if and when required.

The present 2 Waterite vacuum filters, each with 500 ft.² of filter area, give

the plant a filtration capacity of 2,000,000 gpd, yet occupy only 200 ft.² of floor space. Semi-automatic plant operation reduces supervision requirements and contributes to the ease and efficiency of operation which characterize this modern installation.

DIATOMITE FILTRATION

*solves site difficulties
for Montrose
Improvement District*



For more complete information on this plant and on the many advantages of diatomite filtration of municipal water supply, write to

Adding Dicalite Filteraid at the stilling well of a filter during the precoat operation.

Dependable
Dicalite
DIATOMACEOUS MATERIALS

DICALITE DEPARTMENT, Great Lakes Carbon Corporation • 612 So. Flower St., Los Angeles 17, California

Mueller was walking along a sidewalk in Milwaukee, which contained several very badly tilted slabs. The situation was such that some parts of the sidewalk would not drain, as the adjacent lawns, slabs of sidewalk, and parkway between the sidewalks and curb were higher. One slab had a difference of 5% inches from one corner to another. On the day in question, there was a layer of water and slush about two or three inches deep on portions of this sidewalk. In order to keep his feet dry, Mueller attempted to avoid this part of the sidewalk by walking on a snow bank on the adjacent parkway, but he broke through it and injured his ankle. There was proof that the City had had over a year's notice that the sidewalk was defective and had accordingly been marked for removal.

The City contended that the sidewalk opposite the exact point where Mueller fell was in good condition, although it was admittedly defective at points before and after this spot. This defense was brushed aside by the court, on the ground that whether or not Mueller had been reasonable in trying to avoid the entire defective sidewalk area was a question which was properly submitted to the jury.

The jury decided that the city was 70% responsible for negligence, and Mueller 30%. Under the doctrine of comparative negligence, which is in effect in Wisconsin, judgment was therefore rendered for Mueller for 70% of his injuries.

Under the majority rule, where the plaintiff's negligence has contributed in any degree to his injury, he cannot recover any damages whatever. The modern tendency is toward the adoption of the comparative negligence concept, but thus far it has not been adopted in the large majority of states.

• • •

Payment for City Gas by Subdividers

Future subdivisions in Brewton, Ala., must be supplied with city gas service. Sub-dividers will have to pay all costs incident to putting in the gas service, but the money will be refunded. Refunds will be made in units of ten houses—that is, as ten houses are finished and connected to the city system, the city will refund that much. When the area is 80 percent developed, the city will refund all costs to the developers unless the development takes more than two years, in which event the developers will forfeit their rights to the refund.

Up to 72"
LUDLOW

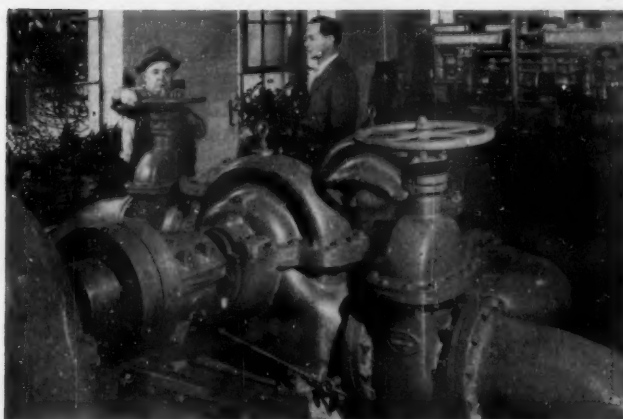
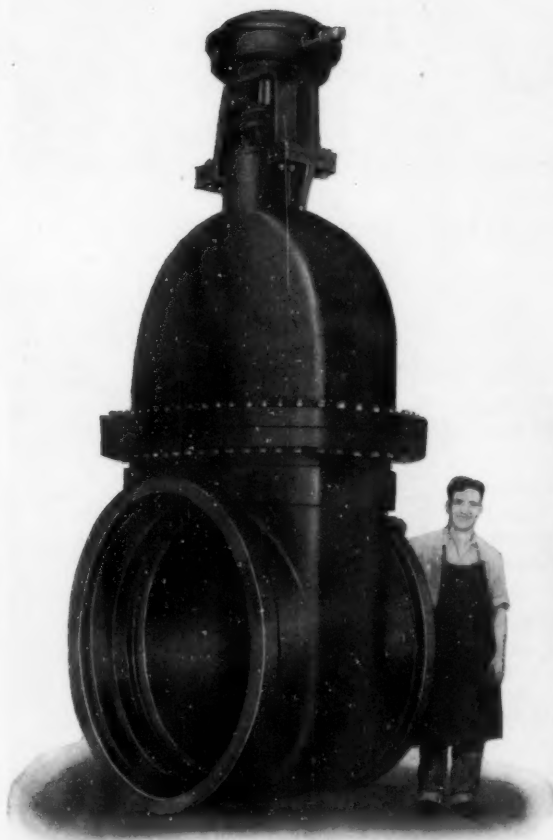
LUDLOW VALVES

The water supply for thousands of people may depend upon a few large valves which must be reliable. Only a huge, specially equipped foundry, backed by giant tools, in a modern precision machine shop can supply this dependability. Ludlow has been the headquarters for large valves for nearly a Century.

LONG LIFE and DEPENDABILITY are built in. Ludlow Valves are fully bronze mounted. The two piece wedging mechanism is simple and rugged. The double disc parallel seat construction results in a wiping action that cleans the seat during the closing operation. The stems are special high tensile strength Ludlow manganese bronze with precision cut modified acme threads. A complete line of sizes from 2" to 72".

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17



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For the past five years, Atlanta has carried on a planned expansion of its water system under the direction of Mr. Paul Weir, general manager of the City's progressive Department of Water Works. Approximately 85 miles of cast iron distribution and feeder mains have been laid each year.

Present daily water requirements of Atlanta are 60 million gallons. By 1960, it is estimated they will be 68 million gallons, and by 1970, 90 million gallons.

When your community plans extension or improvement of its water system, be sure to specify —

Permanent CAST IRON PIPE
"America's No. 1 Tax Saver"

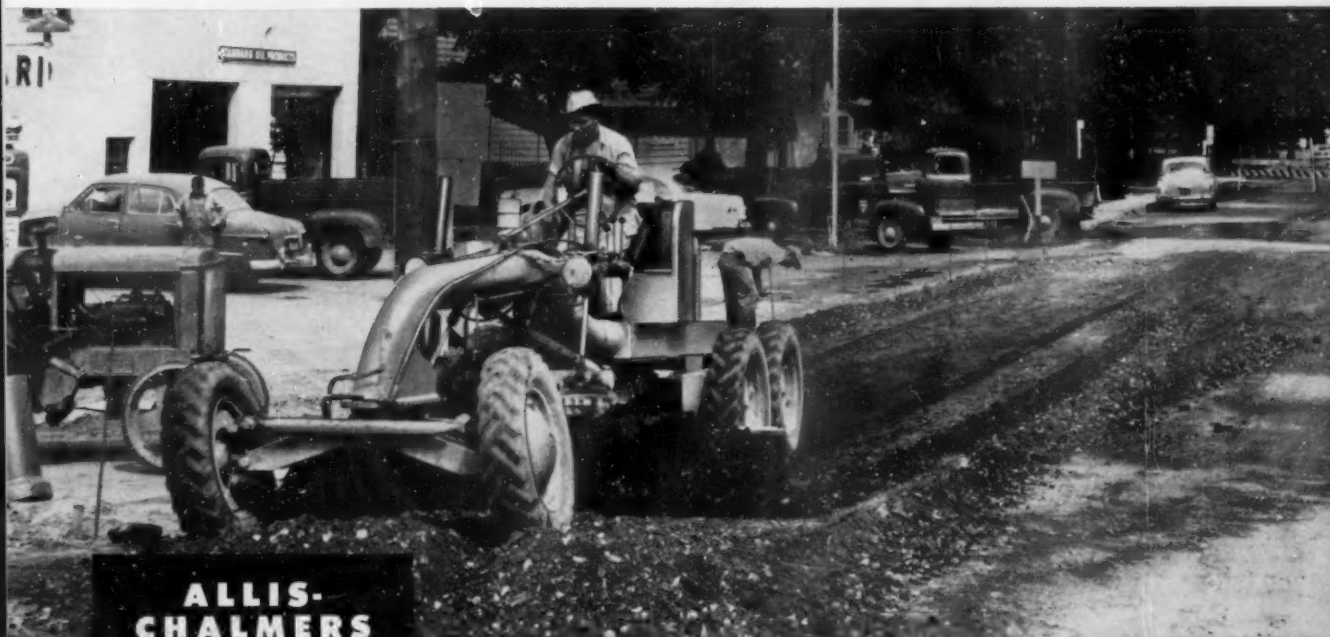
No other pipe has ever matched its proven record of longevity, dependability, low maintenance cost and long run economy. That's why it has long been known as "America's No. 1 Tax Saver."

Our Company does not manufacture Cast Iron Pipe but supplies many of the nation's leading foundries with quality pig iron from which quality pipe is made.



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ROUGH GRADES for curbs, gutters; finish grades shoulders, sidewalks, between forms; cuts and cleans drainage ditches; removes weeds and brush.

Although its original cost is but one-third that of a large motor grader, the Model D has plenty of power to tackle bigger jobs. With either 50-hp gasoline or diesel engine, there's extra torque and lugging ability for top performance on all projects.

Big-grader design means long life for the Model D—regardless of the job. Strong, single-member main frame . . . husky drawbar and one-piece circle . . . work-boosting ROLL-AWAY moldboard . . . ground-gripping tandem drive

. . . precision control . . . easy operation and simple servicing — all contribute to outstanding versatility and performance.

Let your Allis-Chalmers construction machinery dealer show you a Model D in action and tell you more about why it's the grader for your community.

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LOADS OR TRANSPORTS sand, gravel, oil-mix, other bulk materials with $\frac{5}{8}$ -yd. rear-mounted hydraulic bucket. Dumping height of 8 ft, 8 $\frac{1}{2}$ in. allows easy loading of high truck bodies.

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...he'll prefer the new Le Roi Newmatic Air Tools to any other package. They'll warm your worker's heart at X-mas time — and provide a holiday spirit on-the-job all the rest of the year, too!

Every Le Roi Newmatic Air Tool is a prime power pal — air-cushioned for less jarring, longer tool life; balanced for easier handling with less fatigue; precision-constructed for efficient, economical operation with low oil and air consumption. See the complete line of these low-cost tools at your local Le Roi distributor's — or write to the Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

AT-118

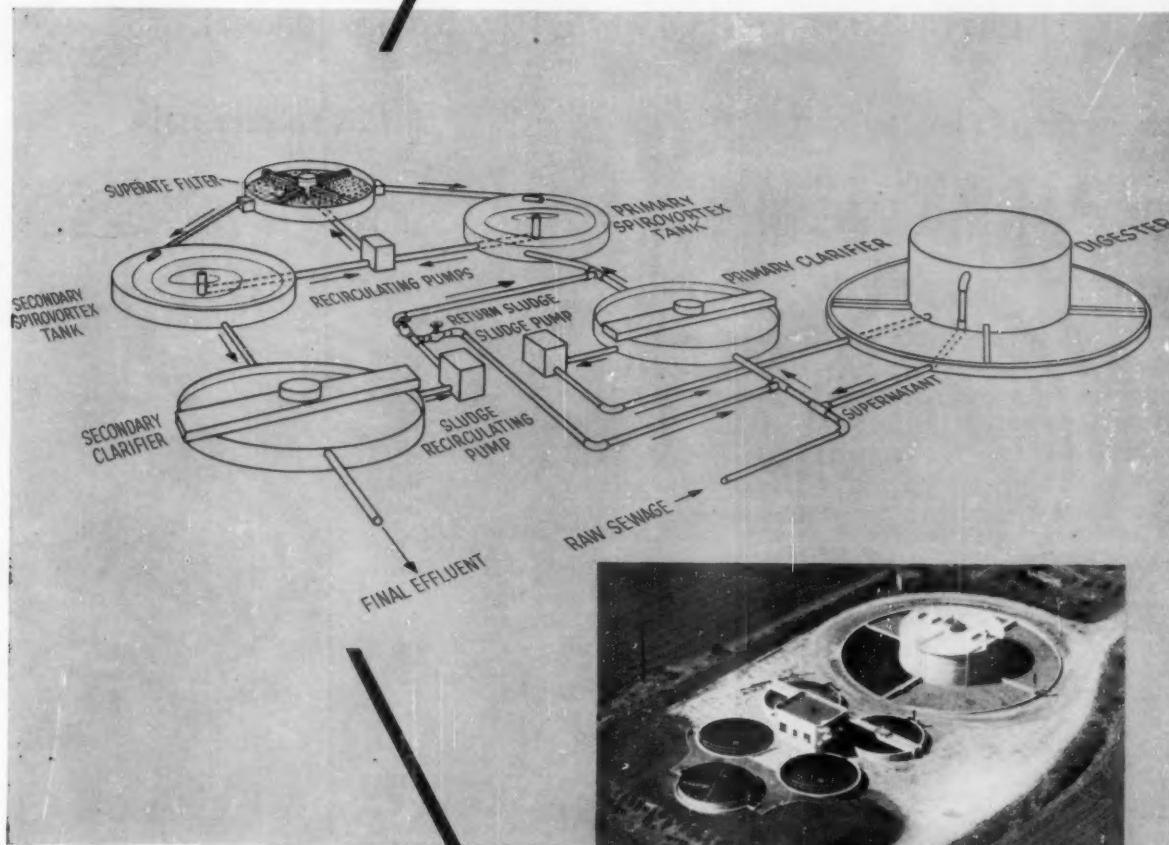
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PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

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It's from **DORR-OLIVER**



THE SPIROVORTEX SYSTEM

Incorporating
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A radically new and different approach to the treatment of domestic sewage and industrial wastes, the Dorr-Oliver SpiroVortex System contains many definite and proven advantages. It is especially suited where 90% B.O.D. removals are required. The headaches caused by bulking of sludge are eliminated as this new System produces an excellent settling sludge, regardless of whether the plant is overloaded or is operating under normal conditions. The high recirculation ratio over the Superate Filter means greater ability to handle changes in raw sewage characteristics under shock load conditions.

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NEW! THE CAT* NO. 7G BULLDOZER



Blade tilts 3' to either side!

Blade tips through a 16½° arc!



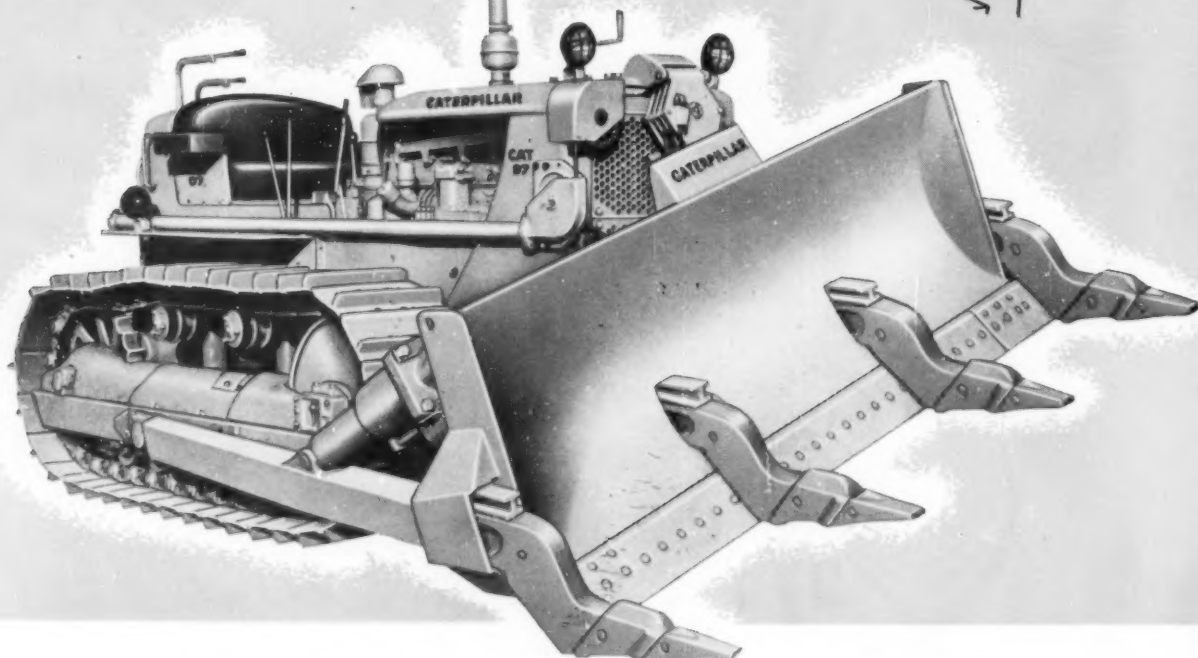
Teeth pick up and carry!

Teeth slice through hard materials!



Teeth easily removed!

Handles easily!



'DOZER AND RIPPER IN ONE

The brand-new Caterpillar No. 7G Bulldozer is a completely different type of bulldozer. The amazing tilt-tip action, and its four heat-treated cast steel teeth, are an entirely new concept in 'dozing. The Gyrodozer is both a 'dozer and a ripper.

YOU'LL GET HIGHER PRODUCTION

The Gyrodozer rips through hard or frozen materials. Its 23" teeth not only pry out boulders but pick 'em up and carry 'em away. In rocky soil, the wedging action of the teeth surfaces small rocks for scooping up by the 10' 10" blade. On the really tough jobs, the tractor's full horsepower can be put behind a single tooth. The Gyrodozer is ideal for uprooting trees and clearing an area in a hurry.

EASY TO OPERATE

A Cat No. 25 Cable Control raises and lowers the 'dozer and a front-mounted No. 44 double-valve Hydraulic Control tips and tilts the blade. The operator never needs to leave his seat to make a blade adjustment.

GET FULL DETAILS

on the revolutionary new Gyrodozer from your Caterpillar Dealer.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

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**WANTED—
THE HARD WORK**

**PUBLIC
WORKS
MAGAZINE**

Vol. 88, No. 12 • DECEMBER 1957

HIGHLIGHTS of RESEARCH in SANITARY ENGINEERING

Research is a precursor to progress. All of us have been made aware of the impact of research on industrial development and on medicine. In this issue, *Public Works* presents a small but diverse sample of current research activities in sanitary engineering. The coverage is not intended to be complete but to illustrate the variety of agencies, topics and professional skills involved. Sanitary engineering has made significant contributions to healthy urban living. The first step in meeting each problem created by the increasing complexity of this environment is research. We, as practitioners to the sanitary engineering field, must help direct men and money into research activities.—

Dr. D. A. Okun

PUBLIC HEALTH SERVICE

RESEARCH GRANTS PROGRAM

HARRY A. FABER,

Research Coordinator,
Engineering Resources Program,
U. S. Public Health Service

SANITARY ENGINEERING research is best considered as a progressive process: it begins with fundamental studies and advances through applied research, engineering development, and process design. The fundamental studies are, of course, essential to the start of this progressive process, and the only way to guarantee technological progress in sanitary engineering tomorrow is to undertake the support of fundamental studies today.

Our present practices in sanitary engineering have been developed by exploiting a few basic ideas mainly discovered at the turn of

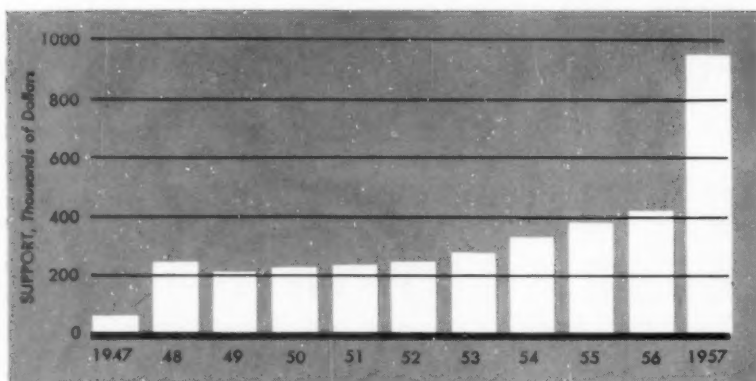
the century. There is no use trying to conceive new developments, to answer our present and future needs, if a part of the foundation of basic fundamental knowledge is missing. Actually, the current status of research knowledge in most aspects of sanitary engineering is relatively primitive.

In order to evaluate our problems and progress in sanitary engineering research, we must have certain facts and figures. We need to know how much research is being done, and we need to know how much should be done.

Various attempts have been made to estimate the magnitude and scope of sanitary engineering research. In 1953, for example, it was reported that 148 sewage and industrial wastes projects were under investigation, and that about one-half of

the projects were supported by Federal funds¹. In 1956 it was estimated that our yearly research expenditures on pollution control totalled almost \$3 million. This total included expenditures by governmental, industrial, and institutional groups. It was stated that very little of the research conducted by industry and by institutions is "fundamental" research².

The Public Health Service contributes to research in sanitary engineering by conducting research within the Service and by supporting it outside the Service. Its own research work is done principally at the Robert A. Taft Sanitary Engineering Center in Cincinnati, Ohio, and related projects in insect and vector control are carried on at the Communicable Disease Center at Savannah, Georgia.



● **RESEARCH GRANTS** in Sanitary Engineering made by the Public Health Service for Fiscal Years 1947 through 1957. These funds went for research in water supply and water pollution control, general engineering and milk and food investigations.

We do have a continuing record of the sanitary engineering research supported by the research grants program of the U.S. Public Health Service which has been in operation since 1947 and has increased substantially in recent years. In the fields of water supply and water pollution control, general engineering, and milk and food, 440 research grants totalling \$3.6 million have received support. The detailed data are shown above by years. The studies are made by investigators at universities and other institutions with employment of graduate students a major fund expenditure.

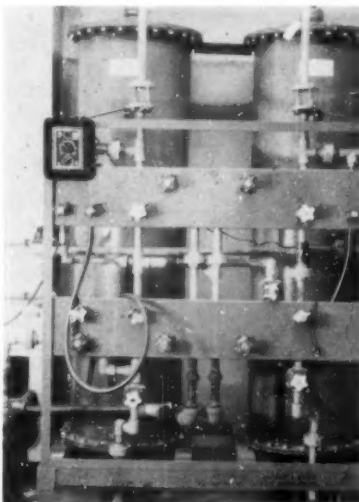
Among the investigations in water supply and water pollution control utilizing research grants in the fiscal year 1957, those concerned with treatment measures were 32; with water pollution, 30; with analytical methods, 12; and with toxicity, 7.

As an example of investigations in the field of water supply, a basic study of water coagulation is being conducted at the University of Florida under the direction of Prof. A. P. Black. Research on protective coatings for water distribution systems is under way at Michigan State University, directed by Prof. Robert F. McCauley. At the Illinois State Water Survey, T. E. Larson is investigating the effect of water treatment methods on water main carrying capacity. Rapid bacteriological determinations by radioisotopic methods are being developed by Prof. Walter C. Hess, of Georgetown University, and Gilbert V. Levin of Resources Research, Washington, D.C.

In water pollution control, the projects involving research grants cover many new aspects of sewage and industrial waste analysis and treatment. A study of the role of oxygen in waste treatment is being

conducted by Prof. Daniel Okun at the University of North Carolina. At Georgia Institute of Technology, Prof. Werner Grune is investigating the analysis of sludge digestion gas by new chromatographic methods. Prof. Rupert H. Kountz is determining the design criteria for total activated sludge treatment in pilot scale studies at Pennsylvania State University. Full scale studies of algae photosynthesis in the treatment and reclamation of sewage are being directed by Prof. P. H. McGauhey at the University of California.

In the general engineering category, research grants are supporting studies of the physical and chemical composition of municipal refuse, directed by Prof. Don E. Bloodgood at Purdue University. At Michigan State University, Prof. Robert F. McCauley and Prof. W.



● **ION EXCHANGE** units for research on protective coatings, a project of interest at Michigan State University.

L. Mallman are conducting studies of aerobic decomposition of organic waste materials. An investigation of the composition and movement of soil gases, and the problem of asphyxiation in manholes and other underground structures, is being made by Prof. George S. Michaelson at the University of Minnesota. At the same University, Prof. George J. Schroeffer is studying the anaerobic contact process for treatment of wastes.

A Plan for the Future

The expenditures by U.S. industry for research and development are rising as never before. Business spent \$4.8 billion for these purposes in 1955, and will spend \$7.3 billion in 1957. A major portion of industrial growth is in industries using the greatest quantities of water; they are, also, industries discharging the more complex industrial wastes. Our problems of water supply will certainly become more intensified and, to solve them, it will be necessary to improve methods of water treatment, to re-use waste water, and to convert saline water to usable supplies.

Our problems of water pollution control can be met by devising cheaper and more efficient treatment methods, and by discovering entirely different ways of treating new contaminants not yet completely identified. Such problems can be solved only by adequate research. We need new facts, new tools, and new techniques to provide basic knowledge in other fields, such as in the disposal of refuse, in food sanitation, and in every application of sanitary engineering to the field of environmental health.

The accelerated rate of research expenditures by industry will create needs for increased investigational work in sanitary engineering. We must recognize that there is no end to research, for research multiplies questions faster than it answers them. We do not know what balance must be maintained between these two, but it is doubtful if our sanitary engineering research is keeping pace with emerging problems resulting from new technological developments.

Adequate financial support for sanitary engineering research must be assured on a scale adequate to protect man's environment. For the most part, this research cannot show the direct profit to industry. Although industry can be counted upon to carry a substantial part of the load, primary dependence must



● SLUDGE digester gas is analyzed by new methods in research at Georgia Tech.

be placed on support by public funds.

The research grants program is developing some of the needed information. The cooperation of technical associations, of trade associa-

tions, and of industry, is resulting in better recognition of over-all research accomplishments and needs. More of such coordination and planning is essential.

The Division of Sanitary Engineering Services has recently undertaken to survey the total research being conducted in the field of sanitary engineering; these basic facts and figures constitute our first need.

One final point—there is a serious lack of scientific manpower capable of conducting practical research in sanitary engineering needs. Some form of subsidy is necessary to interest capable people in this field. The research grants program, through part-time support of graduate students, does have the advantage of developing some of the needed personnel. In addition, support has been provided for a modest program of research fellowship in sanitary engineering. Research grants and research fellowships thus provide a basic contribution to meeting our sanitary engineering needs of the future.

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SANITARY ENGINEERING CENTER

FROM OHIO RIVER SURVEYS to a CLINIC for SANITARY ENGINEERING PROBLEMS

THE ROBERT A. TAFT Sanitary Engineering Center at Cincinnati is a national laboratory of the Public Health Service, U. S. Department of Health, Education, and Welfare. It is devoted to research, training, and technical assistance to the States in the application of engineering and related sciences to the environment for health. As a development from the original Stream Pollution Investigations Station established in 1913, the present Center and its programs illustrate the growth of interest in the manifold problems of air pollution, water supply and water pollution, waste disposal, nuclear radiation, and milk and food processing.

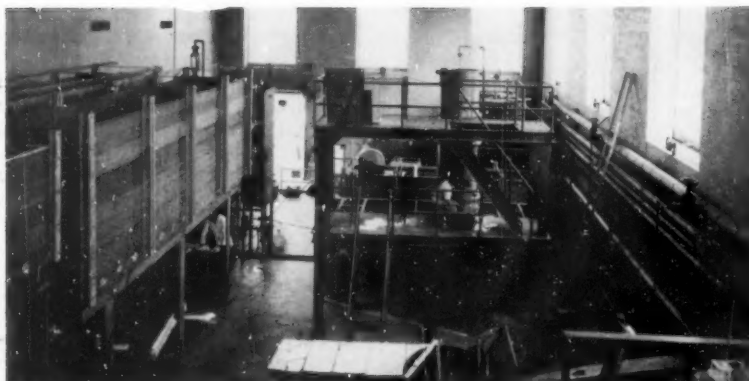
Dollarwise and staffwise the projects related to water supply and water pollution still constitute the principal emphasis of the Center,

but its activities in the areas of radiological health and air pollution have begun to receive almost equally intense attention, not only from the experts but from the general public as well. The programs of the Center have been expanding and accelerating rapidly in the past few years, but there has been still further increase in the requirements of communities, States, and industries for sanitary engineering effort along these lines.

Among the most obvious problems brought daily to the Center's door are those attendant to the rapid growth of communities, subdivisions, and metropolitan complexes. Water supply and treatment, pollution control, sewage and waste disposal, and the newer perplexities of air cleanliness are all coming to be regarded as parts of one and

the same big engineering-for-health package essential to modern living, both in the highly crowded areas and in the relatively open areas beyond. Streams of water and air flow from city to country, from city to city, or from State to State, carrying along whatever wastes have been introduced. Reuse of water is becoming inevitable, leading to closer studies of the methods and load capacities of water treatment and sewage treatment plants. The influence of industrial wastes in municipal treatment systems is a prime subject, and investigations of tastes and odors in water have become a broad field of work for chemists and biologists. Several recent papers from the Center have dealt with these subjects.

The Sanitary Engineering Center has become technical headquarters



● WATER SUPPLY and water pollution experimental wing of the Robert A. Taft Sanitary Engineering Center, with pilot water plant and trickling filter shown.

for an impressive array of environmental monitoring programs, including the National Air Sampling Network, the Water Quality Basic Data Network, a milkshed radioactivity study, and others. These activities are intended to provide long-range information needed for research planning and evaluation. The basic data obtained are of great interest also to the cooperating communities and States in planning their own programs. Through the monitoring networks, the training program, and technical assistance activities such as laboratory evaluations, the Center also promotes more effective use of the research and operating facilities available across the nation.

Aside from the monitoring work, the Center conducts many detailed surveys and demonstration projects. For example, special studies of streams have been made incident to the establishment of uranium mills and nuclear power plants. At least one city, Louisville, Kentucky, has been aided in making a close



● MULTIPLE chamber incinerator design, as it may affect air pollution, is one of the Center study projects.

study of its air pollution conditions, and broad reviews of air pollution problems have been completed in several States.

The training program of the Center resembles a miniature university. In its lecture rooms and laboratories are presented short intensified courses lasting from a few days to several weeks, calculated to bring into immediate use the results of the research underway elsewhere in the building or afield. There is no tuition fee, but the trainees or their sponsoring institutions pay their expenses. These courses are not available elsewhere and are usually filled to capacity.

Publications from the Center include numerous reports and contributions to technical and scientific journals. It is also headquarters for *Public Health Engineering Abstracts*, which has a world-wide distribution. As a special arm of the Public Health Service of the U. S. Department of Health, Education, and Welfare, the Sanitary Engineering center has an important mission in the national health scene and receives international attention as a unique facility for health engineering.

Because space is limited in this presentation, only a few of the Center's projects are summarized here. Those described have been selected as being of particular interest to public works officials and are from the Water Supply and Water Pollution Research Program's current projects.

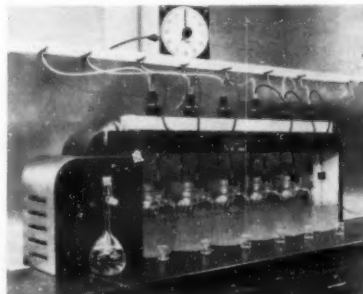
Coagulant Aids Studies

Difficulty with chemical coagulation is widely experienced in water treatment plants. Within recent years, the problem has increased, and while many factors have contributed, probably the most impor-

tant are related to deterioration in raw water quality. Of special interest are the synthetic organic chemicals which are being discharged in constantly increasing quantities into surface waters.

The need to produce satisfactory municipal water supplies has sparked the search for coagulants able to cope with the mounting variety of materials which interfere with the common metal coagulants. Particular attention has been directed to the synthetic organic polymers used as soil conditioners in agriculture. The ability of these compounds to coagulate finely divided clay particles in soil suggests their possible value in chemical treatment of water, a basically similar application.

During the past year the Center has studied several commercial compounds to determine their usefulness in water treatment. These synthetic organic polymers behave like electrolytes in solution, and have been labelled polymeric-electrolytes or polyelectrolytes. Extensive laboratory testing has demonstrated that addition of small amounts of polyelectrolyte, varying



● COAGULANT studies are aided by improvements in jar testing methods.

from 0.1 to 4.0 mg/l, improves significantly the chemical coagulation of surface waters. The floc produced is large in particle size, high in density and settles very rapidly. Other benefits may include appreciable reduction of alum requirements, and reduction in flocculation time by as much as half. Polyelectrolytes are not affected by a wide range of turbidity, hardness or alkalinity and will be effective at all pH values common to water treatment. Continued study is planned to determine the ultimate value of these compounds in water treatment.

Virus Studies

The potential role of sewage and sewage-contaminated water in the transmission of certain human virus

diseases is a matter of increasing interest to public health authorities. This was pointed up in November 1954 when an outbreak of infectious hepatitis occurred in New Delhi, India. Seven thousand cases were reported. However, it was estimated that more than 100,000 cases occurred. Epidemiologists attributed the outbreak to the drinking water supply. A particularly significant fact is that the New Delhi waterworks system is served by a modern treatment plant.

The possible significance of viruses in water only recently has been investigated. This has been stimulated, in part, by the fact that more and more types of viruses have been isolated from human feces, not only from recognized cases of disease, but from normal, healthy individuals. These enteric viruses fall into the following groups: Infectious hepatitis, Poliomyelitis, Coxsackie, Adenovirus, and ECHO or orphan viruses. The latter group is a sort of catch-all into which newly discovered viruses are conveniently placed until their etiological associations are established.

With the exception of the agent of infectious hepatitis, for which no cultural procedure is available to the laboratory, at least one type of each of these groups has been isolated from sewage. The ability of conventional water treatment processes in removing or inactivating these microorganisms is therefore a matter of considerable interest. A recently completed experimental water treatment plant will permit the SEC to do this work. Disinfection studies already have been undertaken. Free chlorine has been found to be effective in destroying Coxsackie and Adenovirus in water. The Center is currently evaluating the efficiencies of iodine and

iodine-chlorine compounds in destroying the viruses of poliomyelitis, Coxsackie and the ECHO group. A new method for removing viruses from water by alum flocculation has been developed as a procedure essential to quantitative study of these materials. The survival of certain of the enteric viruses under various environmental conditions also is being examined.

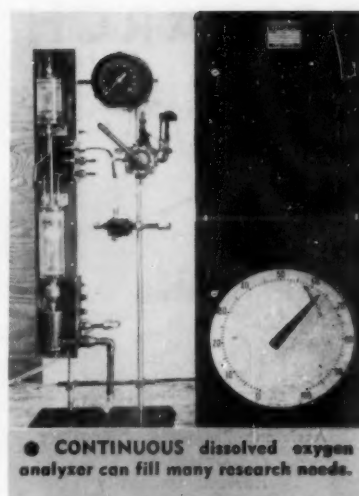
Research on infectious hepatitis, probably the most important member of the enteric virus group, must await the development of practicable laboratory growth and detection method. Attempts are being made to define a tissue culture system which will detect the presence of this virus.

Continuous DO Measurement

Continuous measurement of dissolved oxygen has long been recognized as a practical solution to many economic and technical problems in water pollution abatement and control programs. Hence, there is an interest not only in establishing permanent dissolved oxygen gaging stations at critical points on important streams, but also in developing means for rapidly obtaining the oxygen profile of polluted surface waters.

The design and performance characteristics of a dissolved oxygen analyzer are related to projected uses. Performance requirements usually would call for dissolved oxygen measurements with an accuracy of about ± 5 percent of saturation in the range from 0 to 150 percent of saturation for water temperatures from 0° to 35°C. General application of the method to a variety of water samples would also require accommodation of variations in suspended matter, dissolved solids, and composition and amount of pollution in the water. Design objectives for a dissolved oxygen analyzer include mobility and rapid response to changes in dissolved oxygen content, so that the instrument may be moved rapidly along the stream in a boat to obtain the oxygen profile.

In approaching this problem it is becoming apparent that one instrument may not serve well for both the oxygen gaging station, and as a survey instrument. Of paramount importance in a gaging station is long-term stability and accuracy of the instrument. For survey work, lightness and simplicity may be bought at the expense of cleaning and recalibration of the instrument at intervals of an hour or less. The SEC is presently directing its efforts



● CONTINUOUS dissolved oxygen analyzer can fill many research needs.

toward the instrumental basis of the oxygen gaging station.

The basis for a continuous recording dissolved oxygen analyzer has been developed by the Center. The principle of the method is that of changing the oxygen content of a small quantity of gas to conform in a definite reproducible manner with the dissolved oxygen content of the water. The oxygen content of the gas is then measured, and the machine translates this reading into the dissolved oxygen content of the water. The instrument is designed to accomplish this change continuously as the dissolved oxygen content of the water changes.

In more detail, the instrument contains a gas supply which is used only to maintain the gas in the instrument at constant pressure. The water that is to be analyzed is pumped directly into the "heart" of the instrument, called an aspirator unit. This is the device which quickly changes the gas composition to conform with the dissolved oxygen content of the water. This gas at the same time cycles through a gas analyzer which determines the oxygen content of the gas and records this value in terms of percent of dissolved oxygen content of the water.

This method has the advantage that it is not subject to interferences caused by substances dissolved in polluted water. It will also provide a continuous record of the dissolved oxygen content of the water being analyzed over long periods of time.

Although the successful functioning of the instrument was demonstrated, the design of components of the instrument was not developed in final form. Arrangements for final engineering work on this instrument are being completed.



● REVOLVING rack for cultures is used in the Center's virus studies.

RESEARCH by UNIVERSITIES and EXPERIMENT STATIONS

HARVARD UNIVERSITY

CORROSION STUDIES

WERNER STUMM,

Assistant Professor of Sanitary
Chemistry,
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WE HAVE only a vague knowledge about the correlation of the chemical composition of water and its corrosiveness to an iron pipe. Scientific theories which have been advanced within the last decades have been very helpful in explaining the corrosive behavior of different waters and in providing expedient procedures for water treatment. There are, however, too many exceptions where observed data do not check with theoretical work. It seems that we do not have enough information to be able to predict, without exceptions, the corrosive behavior of water from its chemical composition.

The reader may check the relation of the chemical composition of water and its tendency to corrode by looking at a few examples of different natural waters (Table 1). Corresponding corrosion data are plotted in Figure 1. These data were obtained by exposing cast iron specimens to natural waters under actual field conditions. During the tests, the velocity of the water was kept constant (0.04 ft/sec), and the chemical composition of the waters did not change appreciably. The loss in weight caused by corrosion was determined after careful removal of the corrosion products from the specimens.

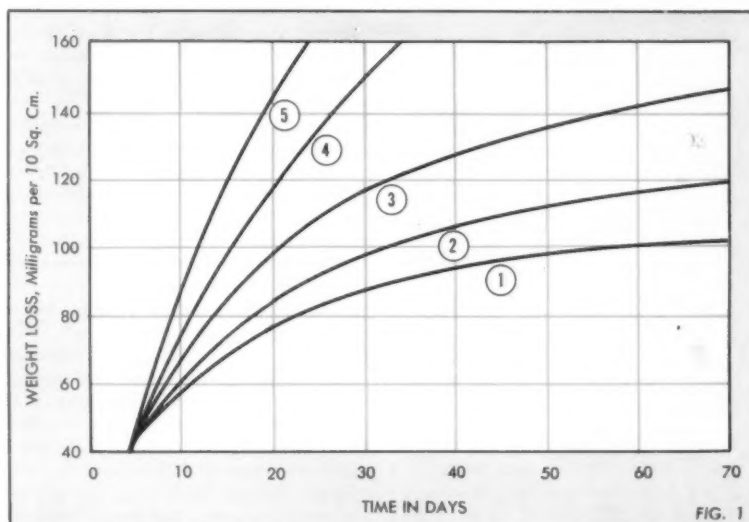
Natural Protective Coatings. At the pH range commonly encountered in natural water, the rate of oxygen supply to the cathodic regions of the iron surface controls the rate of corrosion. If we observe different corrosion rates with different waters which have similar concentrations of dissolved oxygen we must assume that these differences in the corrosiveness are due to natural protective coatings formed on the

pipe surface by corrosion products and by constituents of the water.

Calcium carbonate is thought to be an important component of the natural protective coatings. The chemical equilibria that describe the CaCO_3 solubility (Langelier) can be used to estimate the tendency of a water to deposit CaCO_3 . This concept has been, without any doubt, a very useful guide in water treatment practice. It has, however, limitations. The relative rates of

CaCO_3 deposition at a corroding iron surface cannot be predicted from equilibrium data alone.

Some of the more important electrochemical reactions that take place in a corrosion cell are summarized in Table 2. It is evident that the CaCO_3 deposition at a corroding iron surface is an electrochemical process. In other words, the CaCO_3 solubility equilibrium of the solution will be shifted near the cathodic regions of the iron



● PROGRESS of corrosion with some natural waters. The numbers refer to Table 1.

Table 1—Analyses of Waters Used in Corrosion Experiments

	Water Sample No.				
	1	2	3	4	5
Temperature °C	9.7	10.0	6.4	3-5	11.8
Calcium, mg/l CaCO_3	185	158	99	40	278
Alkalinity, mg/l CaCO_3	245	180	103	12	285
Total Hardness, mg/l CaCO_3	254	195	111	48	315
Oxygen, mg/l	10.2	1.6-3.6	12.5	12.0	5.0-6.1
Chloride, mg/l	2.5	4.5	1.5	—	12
Nitrate, mg N/l	1.5	—	—	—	7.5
pH	7.6	7.5	8.0	7.0	7.1
Saturation Index (pH units)	+0.05	-0.2	-0.2	-1.7	-0.15

surface due to the pH increase by the cathodic reactions.⁹

The writer has analyzed many coatings. It is difficult to establish much correlation between the amount of CaCO_3 in the film and the protective effect of the coating against corrosion. Many cases have been reported where waters being oversaturated with respect to CaCO_3 are detrimental to the pipe, and waters with a negative saturation index show no remarkable corrosion tendency.

It seems that CaCO_3 acts only under certain favorable conditions as a valuable corrosion inhibitor. The investigations of these conditions are the topic of the research of the author.

Preliminary Conclusions. The investigations, up to this time, have

not yielded results from which definite conclusions may be drawn. The following example may give an idea of the complexity of the problem.

Figure 2 herewith shows the results of investigations made with two different waters. In this figure

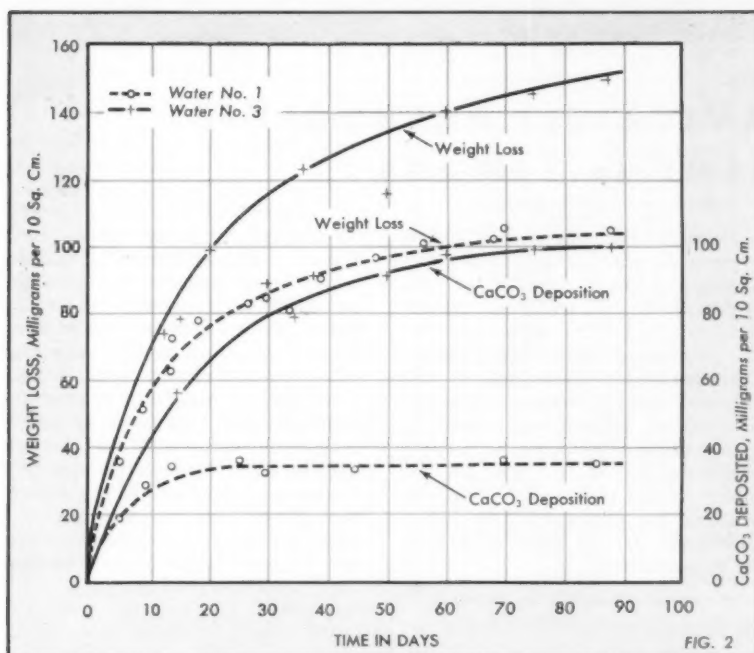
Table 2—Reactions for the Corrosion of Iron in Water

CATHODIC REACTIONS:

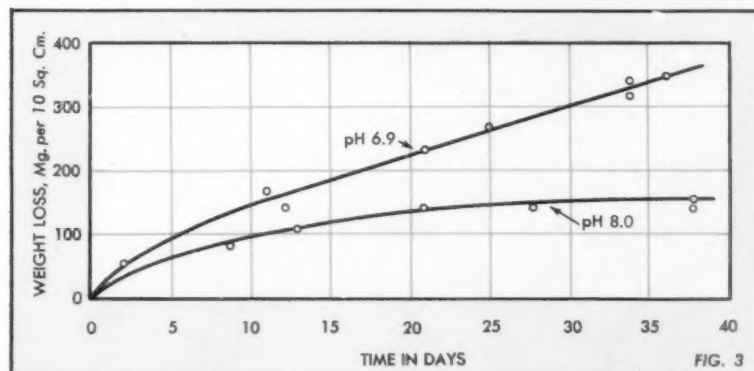
- 1a. $2\text{H}^+ + 2\text{e} = 2\text{H}; 2\text{H} + \frac{1}{2}\text{O}_2 = \text{H}_2\text{O}$
- 1b. $2\text{H}^+ + \frac{1}{2}\text{O}_2 + 2\text{e} = \text{H}_2\text{O}$
2. $\text{Ca}^{++} + \text{HCO}_3^- + \text{H}^+ + \frac{1}{2}\text{O}_2 + 2\text{e} = \text{CaCO}_3 + \text{H}_2\text{O}$
3. $\text{Mg}^{++} + \text{H}_2\text{O} + \frac{1}{2}\text{O}_2 + 2\text{e} = \text{Mg(OH)}_2$
4. $2\text{Fe}^{++} + 3\text{H}_2\text{O} + \frac{1}{2}\text{O}_2 + 4\text{e} = 2\text{Fe(OH)}_3$

ANODIC REACTIONS:

1. $\text{Fe} = \text{Fe}^{++} + 2\text{e}$
2. $\text{Fe} + 2\text{OH}^- = \text{Fe(OH)}_2 + 2\text{e}$
3. $\text{Fe} + \text{CO}_3^{--} = \text{FeCO}_3 + 2\text{e}$



● CORROSION and CaCO_3 deposition rates correlated with the hardness of water.



● INFLUENCE of pH upon corrosion by calcium-free bicarbonate solutions. Velocity is 0.04 fps; temperature, 10°C; $\text{HCO}_3^- = 195 \text{ mg/l}$; $\text{Cl}^- = 14$; $\text{Na}^+ = 83$; and $\text{O}_2 = 10.4$.

weight loss data and CaCO_3 deposition are plotted against time. It is remarkable that the harder water (Water No. 1) that is slightly oversaturated with respect to CaCO_3 deposits less CaCO_3 than the softer water (Water No. 3) which has a negative saturation index. The corrosion reaction produces, in the soft water which has a relatively small buffer capacity, a more significant increase in the pH value and, therefore, a more pronounced shift in the CaCO_3 equilibrium near the metal surface than was the case with the hard water which has a higher buffer capacity.

Our experiments indicate, however, that the CaCO_3 deposited from the hard water is nevertheless more effective in retarding corrosion than the CaCO_3 precipitated from the soft water. It appears that the crystalline state of the CaCO_3 in the film is important. The rate of deposition of CaCO_3 depends on the extent of supersaturation of CaCO_3 on the metal surface. With a high supersaturation it may be deposited in an amorphous or colloid like state. The extent of supersaturation in the immediate neighborhood of the cathodic regions of the metal surface increases remarkably with decreasing buffer capacity and, therefore, with decreasing alkalinity. It seems possible that smoother and better protective films are obtained if the deposition of CaCO_3 occurs slowly. In the process of electro-deposition of metals on cathodes (e.g. galvanizing) smooth protective coatings are obtained only if one keeps the rate of growth of the crystal grains at a minimum. (It is necessary to apply low current density, to add complex formers, etc.)

From the results plotted in Fig. 2 it can be seen that after a relatively short time of exposure, no more CaCO_3 is deposited from the oversaturated water, and CaCO_3 is not dissolved by the slightly aggressive water. We must assume that the corrosion products cling together with the deposited CaCO_3 . The physical character of the coating is

altered with time of exposure; chalk is "cemented" to the pipe wall and shielded by corrosion products. The slightly oversaturated water finds no further crystallization nuclei to continue the deposition, and the slightly aggressive water cannot dissolve CaCO_3 which has been deposited incidentally due to the electrochemical corrosion reaction. The writer was able to show the CaCO_3 is not uniformly distributed within the film. The relative amount of CaCO_3 is highest in the layers closest to the iron surface.⁸

It must not be overlooked, however, that many constituents of a natural water will heavily affect the corrosion inhibiting properties of the film formed on the pipe surface. Figure 3, for example, shows that the pH, independent of its effect upon CaCO_3 deposition, may influence the corrosive behavior of the water. These data indicate that sodium bicarbonate solutions are more corrosive at pH 8 than at pH 6.9. Similar results have been reported by Larson.

By combining electrochemical, crystallographic and colloidal chem-

ical methods, the author hopes to be able to arrive at more reliable conclusions about the role of CaCO_3 as a corrosion inhibitor.

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UNIVERSITY of COLORADO

THE SURVIVAL of PATHOGENIC ORGANISMS in SEWAGE

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University of Colorado School of
Medicine

This study was supported by grants from the National Institutes of Health, USPHS, Department of Health, Education and Welfare.

IT IS A POPULAR belief that sewage treatment, even primary settling with chlorination, will remove all disease-producing microorganisms from a sewage effluent. That this is not so has been the basis of a number of years of research by the writer and his associates. We have been particularly interested in this problem because of the widespread use of such effluents in the West for the irrigation of truck crops, many of which are eaten raw.

From 1949 to 1952 attempts were made to isolate *Salmonella* bacteria, including the typhoid organism, from 142 samples of irrigation water contaminated with a chlorinated primary effluent. By improvement of the methods used it was possible to isolate these pathogens from nearly 80 percent of the samples of water examined. Furthermore, a direct correlation was demonstrated between the most probable number of coliform organisms and enterococci (fecal streptococci) in the water and the incidence of *Salmonella*. This is shown in Table 1. The average coliform density of a water

positive for *Salmonella* was 250,000 organisms per 100 ml, while the average coliform density of the negatives was only 34,000 per 100 ml. Similar correlations are evident for the enterococci. It is thus apparent that significant reductions in the coliform and enterococcus populations of an effluent will result in fewer disease-producing *Salmonella* organisms in that effluent. On the other hand, unless the coliform count of the effluent is kept below 23,000 per 100 ml, *Salmonella* may be demonstrated.

Similarly, studies have been made of the incidence of animal parasites in sewage and sewage-contaminated irrigation water. As few studies have been made of these organisms in an actual treatment plant, the fate of two types of these parasites, *Ascaris* ova and *Endamoeba coli* cysts, was followed beginning with raw sewage and following the flow through the primary treatment, including chlorination of the effluent, out into the receiving river and down to the first farm on one irrigation ditch. It may be seen



● IRRIGATING onions with sewage-contaminated water is typical of the practices subject to Dr. Dunlop's investigations on the exposure of vegetables to pathogens.

Table 1—Coliform Organisms and Enterococci in Irrigation Water, MPN in Thousands per 100 ml

	All Samples		Salmonella Positive		Salmonella Negative	
	Coli	Entero	Coli	Entero	Coli	Entero
Median	230	4.3	230	19	34 ¹	0.32 ¹
High	>11,000	93	>11,000	93	43	0.43
Low	15	0.093	23	0.43	15	0.093

Note 1. Arithmetic average.

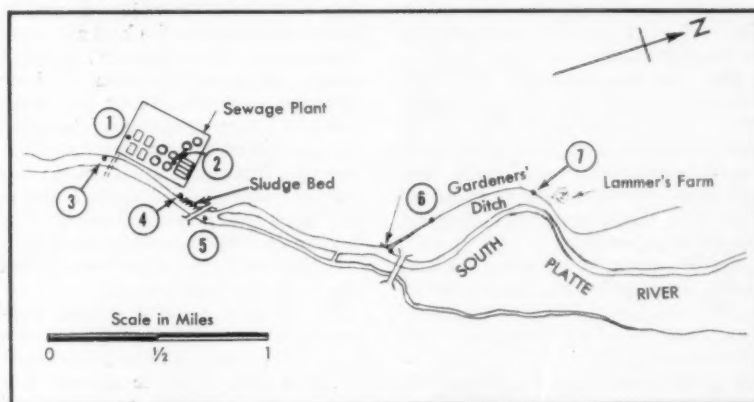
from Table 2 that approximately half the *Ascaris* ova and *End. coli* cysts were removed by the primary settling. In the chlorinated effluent, only 20 percent of the *Ascaris* ova remained, but 46 percent of the cysts were still present. It was also demonstrated that most of the cysts were probably still viable at this time. Below the plant, however, in the river and in the irrigation ditch, considerable additional removal was effected, probably by settling. Coliform and enterococcus indices run concurrently on these samples showed an average reduction of 99 percent of these bacterial organisms in the effluent of the plant. Thus primary treatment, even with terminal chlorination, is considerably less effective against these animal parasites than it is against bacteria.

Fortunately, studies on the edible portions of vegetables irrigated with these contaminated effluents yielded very few positives. Only one of 89 samples of vegetables was positive for *Salmonella*, only 2 of 34 samples were positive for helminth ova. However, in the light of more recent information to follow, and because recovery experiments showed tremendous reductions of known organisms added to vegetable wash-

ings, it is planned to reinvestigate the vegetable studies.

We are currently studying the fate of *Shigella* (bacillary dysentery) organisms in sewage and irrigation water. Although these organisms, like the *Salmonella*, are associated frequently with man's excreta, they have not been isolated from sewage effluents or river water to our knowledge. The presence of bacteriophages specific for the *Shigella* have been demonstrated in sewage and river water, however,

and this fact has been used to explain the negative findings of the organisms themselves. Recovery experiments in which *Shigella* were added to sterile sewage have led us to believe, on the other hand, that this is not the only explanation. Indeed, we have recently demonstrated that a lack of sodium or potassium ions in the sewage, coupled with a high pH, make the isolation of *Shigella* very difficult, if not impossible, on the selective media required. Conversely, adding these ions as chlorides and phosphates and lowering the pH to about 7.5 results in the recovery of as few as 10 *Shigella* added per ml of irrigation water. A few experiments in which sodium chloride and potassium phosphates were added to natural sewage or irrigation water have not yielded any positives, however. It is planned to continue this work with the *Shigella* and also to apply this knowledge in the re-investigation of the incidence of *Salmonella* on vegetables irrigated with contaminated water.



● SAMPLING points on the South Platte River which yielded the data in Table 2.

Table 2—Effect of Primary Sewage Treatment on Removal of Animal Parasites, Denver Sewage Disposal Plant

Sampling Point	<i>Ascaris</i> Ova				<i>End. coli</i> Cysts			
	Number Ova per liter	Range	Pos. Samp. No. Samp.	% reduction from raw	No. Cysts per liter	Range	Pos. Samp. No. Samp.	% reduction from raw
1—Raw Sewage	30	5-110	11/11	—	52	20-110	11/11	—
2—Settled Sewage	15	2-30	11/11	50	27	5-50	11/11	48
3—River above	<1	0-<1	2/11	—	<1	0-<1	1/11	—
4—Effluent	6	0-20	9/11	80	24	6-71	11/11	54
5—River below	6	0-14	10/11	80	8	6-17	9/11	85
6—Gardeners' Ditch (flume)	2	0-6	5/6	93	6	0-17	5/6	88
7—Gardeners' Ditch (Lammer's headgate)	1	0-6	4/6	97	4	1-14	6/6	92

Ascaris Ova: by Zinc Sulfate Concentration Method.

Endamoeba coli Cysts: by Aerosol-Ether-Xylene Concentration Method.

LAWRENCE EXPERIMENT STATION

BIOLOGICAL TREATMENT of TANNERY WASTES

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PROGRESSIVELY poorer results were being found at a municipal sewage treatment plant which included a conventional settling tank and a single-stage trickling filter. In 1956 investigation showed that a tannery waste made up about 60 percent of the volume of the influent. The domestic sewage had a BOD of about 150 mg/l and the tannery waste accounted for well over 75 percent of the total BOD. The pH of the mixed sewage and waste was at times as high as 12.

Removal of solids and BOD by settling was negligible, and there was very little removal of BOD by the trickling filter. The stone was rapidly becoming coated with lime and organic matter, and it appeared probable that complete clogging would soon result.

Daily composite samples of the waste were collected. They showed a BOD of about 1000 mg/l with a maximum of about 2500. The pH was generally close to 12. The average caustic alkalinity was about 1200 with a maximum of over 3000. Sulfide content was generally over 100 mg/l. Calcium ran as high as 1200 with an average of almost 300. From these data it was obvious that pre-

liminary treatment of the waste was urgently necessary.

Addition of hydrochloric acid to pH 7 and pH 5, of course, removed the caustic alkalinity but had little effect on the amount of calcium and sulfides present, and both of these substances were obviously interfering with the operation of the filter.

Carbon dioxide from simulated flue gas was tried next. It was found that pH could be reduced to 7 by bubbling gas with satisfactory removal of carbonates, of sulfides, and some removal of BOD. However, it was shown that maximum removal of calcium to about 70 percent occurred at pH 8.5 and calcium tended to redissolve if the pH dropped below that point. A series of experiments showed that the best all round results from the standpoint of BOD, calcium and sulfides resulted from adjustment to pH 8.9. At this point nearly 80 percent of the calcium and 60 percent of the sulfides were removed. The removal of BOD was on the order of 25 percent. A series of Warburg runs indicated that maximum oxygen uptake after both two days and five days were shown at about this pH.

While these experiments on pretreatment were being made, a trickling filter, 6 feet in depth, was seeded, first with domestic sewage, and then with a dilute maximum of sewage and coagulated waste. Following this seeding period, the application of carbonated waste mixed with settled domestic sewage was

begun at a liquid loading of 1.1 mgad which, after two weeks, was doubled. No recirculation was used at the beginning of this experiment. In the last week of operation under these conditions a BOD removal of over 75 percent of the 1238 pounds applied per acre foot was found.

Recirculation was then begun. The entire volume of effluent was recirculated each day so that the ratio was 1:1. After the first week the BOD reduction jumped to 90 percent. In the next few weeks the liquid rate was gradually increased to 4.4 mgad, which was the original

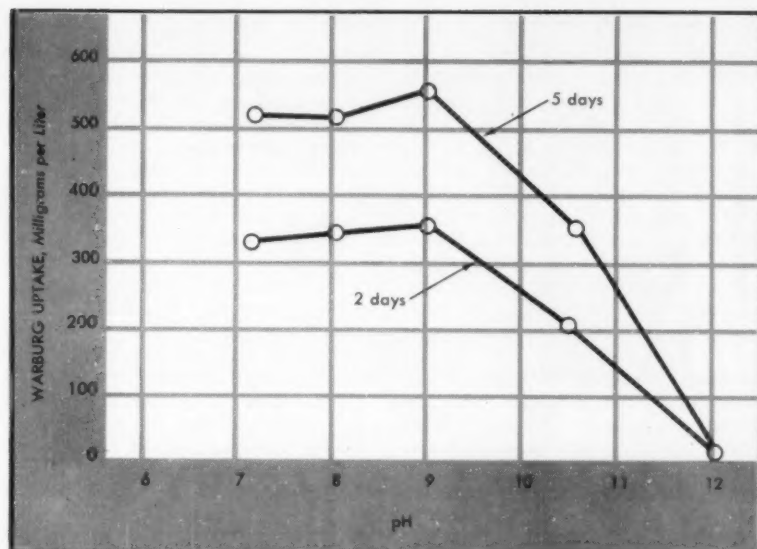
**Table 2—Typical Daily Results
Trickling Filter Treatment of
Sewage and Carbonated
Tannery Waste**

	Applied mg/l	Effluent mg/l
Total solids:		
Total	3,550	3,180
Loss on ignition	650	250
Suspended Solids:		
Total	180	27
Loss on ignition	165	23
pH	7.8	7.5
Alkalinity, methyl orange	386	169
Calcium	40	40
Sulfides as S ⁼	58	0
Kjeldahl N	95	47
Nitrite N	—	1.5
Nitrate N	—	0.5
BOD	590	52

**Table 1—Results of Trickling Filter Treatment of Sewage and Carbonated Tannery Waste,
Typical Average Analyses**

Rate of Application* mgad	Recircula- tion Ratio	Loadings, lb/1000 cu. ft.	BOD			Calcium		Sulfides	
			Applied, mg/l	Effluent, mg/l	Percent Removal	Applied, mg/l	Effluent, mg/l	Applied, mg/l	Effluent, mg/l
1.1	None	44	666	134	80	41	51	60	4
2.2	1:1	52	390	39	90	52	55	27	0
3.3	1:1	105	525	78	85	50	57	40	0
4.4	1:1	120	454	45	90	—	—	14	0
4.4	2:1	177	667	80	88	—	—	—	0
4.4	3:1	150	565	63	89	—	—	—	0

*includes raw mixture only.



● EFFECT of pH adjustment by carbonation on oxygen uptake of tannery wastes.

design rate for the municipal filter. The recirculation ratio had been maintained at 1:1. Over the last three weeks of operation under these conditions, with two days omitted, the average BOD was 520 mg/l and the removal was 89 percent. On the two days omitted from this average the tannery waste was extremely strong so that the BOD of the mixture applied to the filter was over 1000 mg/l. In spite of this, the average BOD over the two days was 196 mg/l or a removal of 81 percent. On the following three days the strength of the waste returned to normal and the BOD removal again

increased to the 90 percent level.

In the next stage of the investigation the recirculation ratio was increased first 2:1 and then 3:1. Although the strength of the applied waste was relatively high during this period, the removal of BOD remained close to 90 percent.

Tables 1 and 2 give the typical average analyses over several of the periods during the operation of this filter and a typical analysis of the applied mixture and effluent on one day.

The calcium in the treated waste was reduced to about 100 mg/l so that the mixed liquors averaged

about one-half that. The effluent was found to have about the same content indicating that no deposit of lime was occurring. Careful examination of the stone in the filter confirmed this observation.

The content of sulfides in the applied mixture ranged from 15 to 100 mg/l but at no time was there found more than 4 mg/l in the effluent.

It seems probable that the control of pH, calcium and sulfide by the carbonation method is at least as important as any reduction in BOD. The experiments appear to demonstrate that with this type of pretreatment of the waste before mixing with sewage the trickling filter should be expected to remove nearly 90 percent of the BOD applied with the liquid load of raw mixture of about 4.4 mgad, or a total liquid rate of 14 to 18 mgad, and a BOD loading of about 3800 pounds per acre foot, or 90 lbs. per 1000 cu. ft. per day.

Simultaneous experiments were run on activated sludge treatment of the treated tannery waste alone. A deficiency in phosphate was made up throughout the experiments. The first runs were made with diluted waste with the detention period 24 hours. The concentration of the waste was gradually increased and the retention time was finally reduced to 12 hours. At that time the BOD applied averaged 1360 mg/l with an effluent of 136, or a removal of exactly 90 percent. The loading was 170 lbs. per 1000 cu. ft. Throughout the runs sludge solids were maintained at about 7000 mg/l.

MELLON INSTITUTE of INDUSTRIAL RESEARCH

ORIGIN of TASTES and ODORS in DRINKING WATER

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THE TENDENCY of waterworks operators to blame malflavors on industrial wastes is understandable, because notable taste epidemics have resulted from heavy discharges of manufacturing wastes. Nevertheless, there is increasing evidence that a majority of taste and odor problems have natural causes. With

better knowledge of the role played by algae, Actinomycetes, decaying vegetation, and biological activity in streams, there has been a trend toward placing the blame on actual rather than presumed factors.

A great many compounds are odorous in low concentration, and sometimes a minor alteration in molecular structure will produce a marked change in odor. For example, there is an eight-fold difference in odor threshold among the three cresols; this difference is about 60-fold for the monochloro-

phenols, and 500-fold for the dimethylphenols.

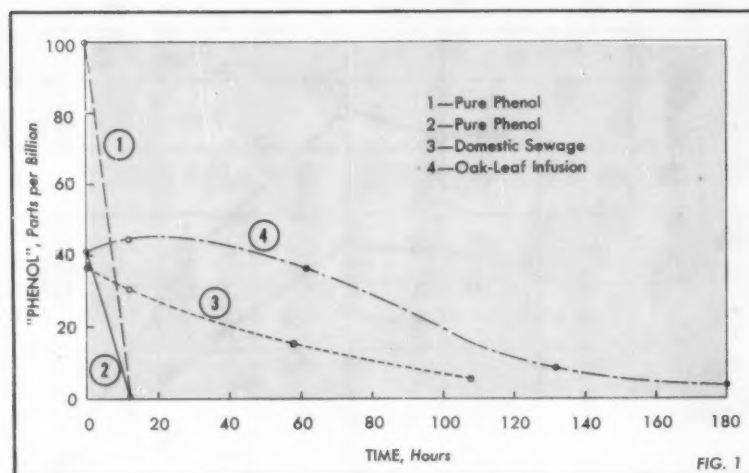
Biochemical Effects. The pronounced effects of the kind and location of phenolic substituents make the problem of identification of taste-producing substances very difficult because natural water is a dynamic medium in which biochemical alteration of organic compounds occurs continuously. There is a constant struggle for life in streams, wherein all organisms prey upon those lower in the evolutionary scale, and, in turn, are devoured

by more advanced creatures. Bacteria, which have the simplest structure of living things in streams, must depend on dissolved or suspended matter for their food supply. Practically any organic material can be used as food by bacteria, but the differing enzyme systems of these organisms narrowly limit the compounds that can be utilized by an individual strain. In the complex processes of ingestion, such material is converted into energy, new cell substance, and metabolic by-products. Thus it happens that certain species of bacteria consume phenolic compounds, while others produce them as products of their metabolism. This led to the supposition that there might be a phenol equilibrium in streams, brought about by a relative balance among phenol producers and consumers. The hypothesis is supported by the fact that streams draining uninhabited watersheds normally contain 3 to 20 ppb of phenol, as shown by numerous analyses.

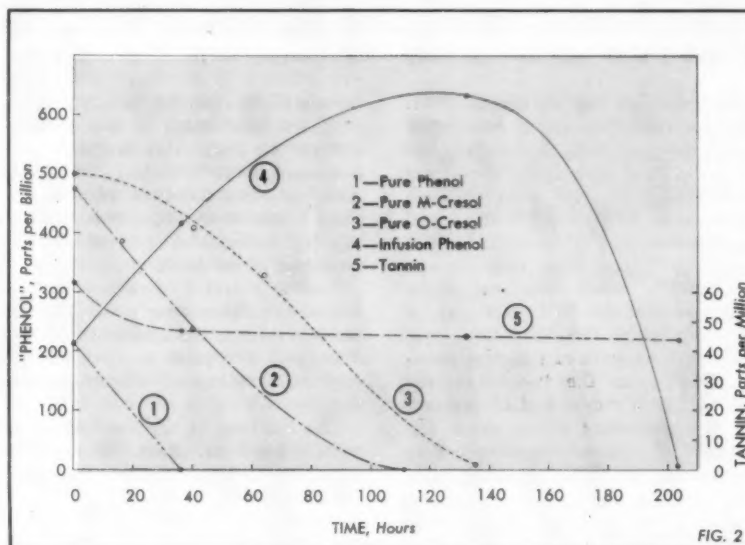
Natural Phenol Production. A laboratory investigation, which is still in progress, was undertaken to elucidate the manner by which phenols might be generated in Nature. Tannin has been suspected as a source of natural phenols. The hydrolyzable tannins have no definite chemical composition but appear to be mixtures of polygalloyl glucose units with eight to ten gallic acid residues per glucose molecule. These numerous phenyl groups suggested that tannin might yield various phenols during biological decay.

Dried oak leaves were picked from trees and fermented in sterile distilled water under aseptic conditions and samples were withdrawn at intervals for analysis by the DAAP method. After five days the concentration of phenols was 209 ppb; the concentration rose to 307 ppb at 19 days and then gradually declined to 239 ppb at 75 days, averaging 264 ppb. Tannin, as measured by the Folin-Denis procedure, rose from 90 to 180 mg/l during the experiment, while total and dissolved solids increased about 10 percent and color remained fairly constant at 2200 mg/l. The infusion had a strong, disagreeable odor which could be described as musty, pigpen, and sulfuretted at various stages.

Analytical Difficulties. An obstacle to the study of odorous compounds from biological decomposition is the lack of analytical methods of suitable specificity. Various techniques are being used to provide clues to the composition



● PHENOL has a variable decay rate, depending on the nature of the medium used.



● THE MORE complicated the molecular structure, the less rapid the phenol decay.

of these complex solutions. Paper chromatography has shown that phenol, ortho- and meta-cresol, and guaiacol (orthomethoxy phenol) were present in the infusion. It is notable that pure guaiacol can be detected at a concentration of 2.5 ppb in odor-free water. Gas-liquid partition chromatography has not yet been a useful analytical tool because of the complexity and low volatility of many of the infusion constituents. Infrared spectrography has disclosed the presence of hydroxy and/or amino, aliphatic, carbonyl, methylene, and methyl functional groups. In general, the phenolic material appears to consist of highly-substituted, single-ring compounds.

Paper chromatographic techniques are being developed as a means for

qualitative identification of unknown substances. In practice, mixtures of known compounds are chromatographed in parallel with the unknowns.

Natural Decay of Phenols. Organic matter is dissimilated more or less rapidly in streams, and phenols are no exception, particularly where there is a history of pollution from domestic sewage or industrial phenol. The rates of decay of various phenols in raw river water were measured in the laboratory. The results of some of this work are plotted in Figures 1 and 2. The data show that the simpler the molecular structure the more rapidly the phenols decay. It may be seen that pure phenol is dissimilated rapidly, cresol much less rapidly, and the phenols in sewage and infusion

liquor rather slowly. The curves for infusion phenol show an initial increase in concentration, followed by a slow decrease. Figure 2 shows a determination of tannin concentration corresponding to measurements of infusion phenols; this suggests that the tannin at first yielded phenol more rapidly than it could be consumed by the bacterial strains present.

River Survey. Data collected by the Steel Industry Committee of the Ohio River Valley Water Sanitation Commission during a two-year phenol survey of the Monongahela and Ohio rivers tend to support the contention that most phenolic material has a natural origin. Normal discharge of phenol from all by-product coke plants on the 112-mile stream section sampled was 4000 lb/day, yet the survey showed loads ranging from 10,000 to 25,000 lb/day for considerable periods of time. The survey also disclosed another interesting feature. A plot of the river hydrograph, phenol loads, and phenol concentrations for

each of the 19 sampling points showed that these factors followed the same pattern during a heavy runoff from rainfall after a dry spell, i.e., phenol load and concentration increased with runoff. Where another runoff occurred soon after the first, the phenol parameters increased somewhat, but if a third runoff occurred they were altered very little. This indicates that phenolic material was leached out of decaying vegetation more or less completely after the second heavy runoff.

There is more convincing support, however, for the hypothesis that most phenolic material in these rivers is generated naturally. During the 1956 steel strike 27 sets of daily samples were collected at five of the sampling points used in the phenol survey. Calculation of phenol loads from analyses of these samples showed that the amount of phenol was not appreciably different from a comparable period in 1954 when the by-product coke ovens were operating at full capacity. All data

were subjected to rigorous statistical analysis, and appropriate adjustments were made to correct for differences in stream flow for the two periods.

This brief account of current research on tastes and odors has been limited to phenolic substances for several reasons. Phenol has been more frequently blamed than any other compound for malflavors in drinking water. This has come about from the finding many years ago that partial chlorination of phenol resulted in a pronounced medicinal taste; that heavy discharges of undephenolized coke plant still waste caused a bad taste in water; and that a sensitive analytical method was available for phenols. Evidence is gradually accumulating that phenol concentration below about 75 ppb is not an important taste-and-odor factor. It may be anticipated that research will eventually identify the most troublesome compounds, locate their sources, and develop means for eliminating them at waterworks.

NEW YORK UNIVERSITY

TREATMENT of RADIOACTIVE LAUNDRY WASTES

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AMONG the subjects of investigation at New York University have been the effects of radioactivity on sewage treatment processes, the treatment of T.N.T. manufacturing wastes, the effect of synthetic detergents on the activated sludge process, deep trickling filters with sewage being fed at several depths below the surface, the mechanism of oxygen transfer in aeration processes, incinerator design and the development of wind tunnel methods for the study of air pollution.

A recently completed investigation, sponsored by the U. S. Atomic Energy Commission, was concerned with the possibility of using conventional biological processes for the treatment of laundry wastes containing low concentrations of radioactive materials in addition to the organic pollutants. The waste

studied at New York University contained citric and nitric acid rinse waters in addition to the usual detergents. The pH ranged from 3.0 to 5.0; the BOD, from 200 to 800 mg/l; and the Beta radioactivity, due to mixed fission products, from 3 to 180 disintegrations per minute per milliliter. Ammonium hydroxide and trisodium phosphate were added as supplementary nutrients. Some of the experiments were made with an actual laundry waste and some with a solution prepared to simulate the actual waste. They were treated on 6-in. and 12-in. diameter trickling filters under a wide range of loading and recirculation rates. BOD loadings varying between 100 and 2000 pounds per acre-ft per day and hydraulic loadings between 1.0 and 15.0 mgad were employed.

The illustrations show the pilot plant used in some of the studies. Each filter consisted of two 12-in. diameter vitrified clay sewer pipe sections joined together, providing a total filter depth of 4 ft. The filtering material was trap rock in sizes

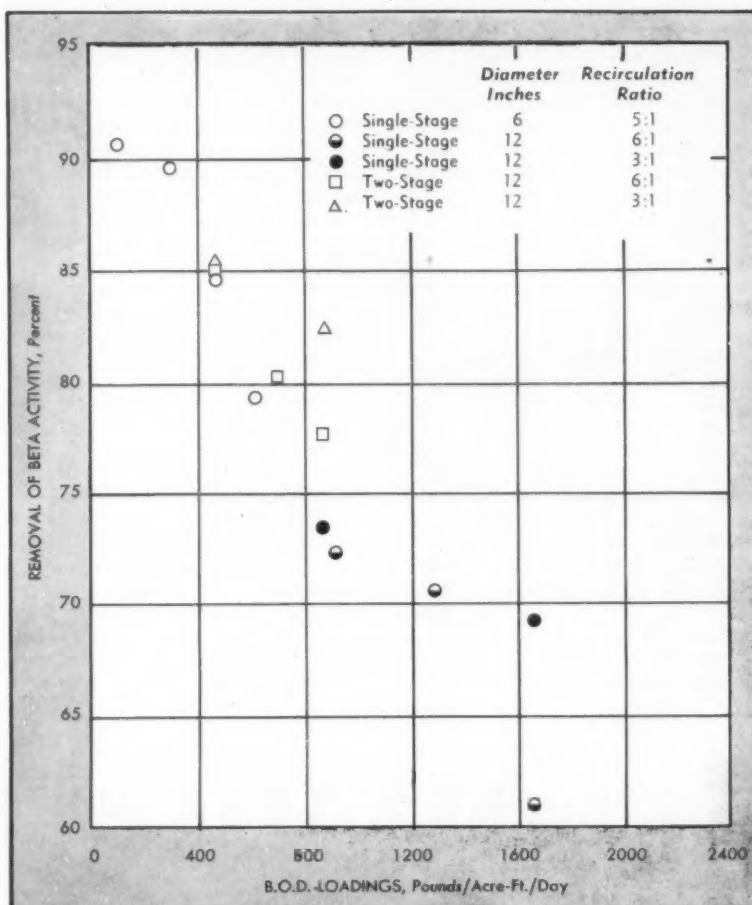
ranging from 1 to 3 ins. The 10 filters were arranged so that they could be used as 10 separate units or as five two-stage plants. The distribution of the feed into each filter was accomplished by means of a small siphon and a rotary distributor made of plastic tubing. In small scale experiments with biologically active solutions, considerable difficulty is usually encountered in maintaining constant rates of flow because of clogging caused by growths in the lines. In these experiments the difficulty was compounded by the necessity of dividing an overall small rate of flow into 10 streams of different size. This was accomplished by feeding the entire flow into a distributor tube which rotated and discharged at a constant rate into an annular space divided into 10 compartments. The compartments were connected by plastic tubing to the siphons on the various filters, the relative dosing rates being regulated by varying the sizes of the compartments. Recirculation pumping to each unit was accomplished

by the alternate compressing and release of a piece of rubber tubing provided with ball check valves on both the suction and discharge lines.

Growths on the filter stone were very profuse, although the variety of organisms was reduced considerably from the usual inhabitants of trickling filters treating domestic sewage. The sludge consisted mainly of zooglia with some crustaceous flagellates and worms. The BOD removals were about the same as would be obtained from domestic sewage under the same loading rates. The percentage removal of the radioactive materials decreased as the loading rates increased as is shown on the diagram.

Under any particular loading condition the radioactivity of the sludge which was produced increased gradually and finally leveled off at a relatively constant value. This equilibrium was reached when the rate of elimination of active materials from the filter in the sludge equalled those being removed from the waste solution. The final activity levels reached by the sludge from the filters with different loading rates were all about the same value and about 200 times as high as the activity level of the waste being fed. While the most heavily loaded filters removed more total activity than the lightly loaded ones, they also produced proportionately more sludge.

These experiments showed that removals of about 80 to 90 percent of the mixed fission product activity could be removed from radioactive contaminated laundry waste, at loading rates which also produced



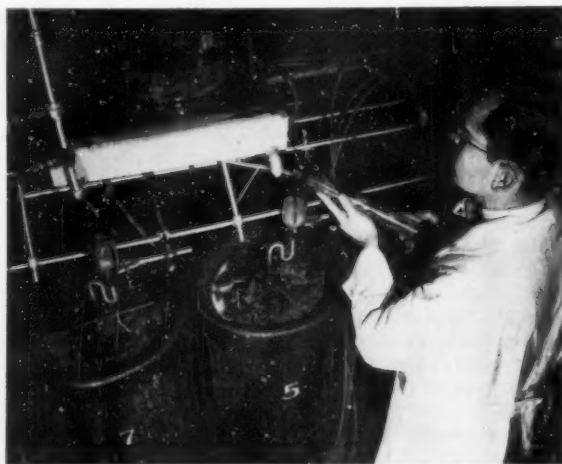
● DIAGRAM showing BOD loadings vs. activity removals from pilot plant studies.

a BOD removal of over 90 percent. Although the radioactivity of the effluent might still be too high in some cases to permit its direct dis-

posal, the process might be useful in cleaning up the waste preparatory to its treatment by other means of radioactive decontamination.



● RADIOCHEMICAL laboratory at New York University, where removal of radioactivity from wastes was determined. It was found that the percentage removal of Beta activity by the pilot plant decreased as the loading rates were increased.



● PILOT PLANT used in studies of radioactive laundry waste treatment. Filters are 4 ft. deep; 6 and 12-ins. in diameter. Dosing rate for individual filters is controlled by adjustable distributor boxes shown at top of the photo.

UNIVERSITY of CALIFORNIA

STUDIES of DETERGENT BREAK-DOWN and AIR POLLUTION by INEFFICIENT COMBUSTION

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Sanitary Engineering Research
Laboratory
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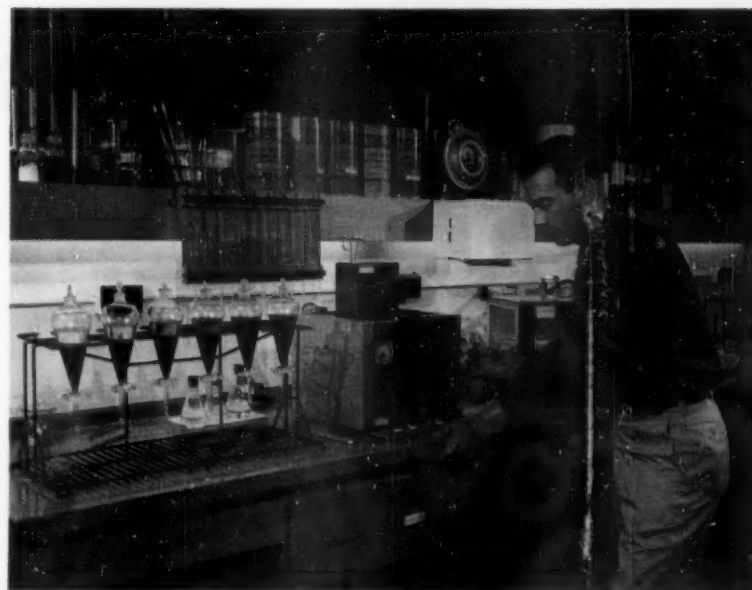
SOME of the projects of the Sanitary Engineering Research Laboratory, University of California, are designed to add to the growing fund of basic knowledge leading to more effective and economical treatment of water and wastes through improved plant design and process control. Other projects are intended to point the way to processes adaptable to new and changing problems in environmental sanitation; or in some cases to define the problems themselves. Specific studies are in progress in five general problem areas:

1. Fundamental scientific and engineering principles underlying water and waste treatment. Typical investigations deal with the oxygen demand of decomposing organic matter, the phenomena associated with flocculation and sedimentation, and the survival of sewage bacteria in soil.

2. Water pollution and water and waste treatment problems which result from the widespread use of new products or industrial processes which alter the nature of municipal wastes. Studies of the fate of synthetic detergents during sewage treatment are illustrative of this category of research.

3. Environmental problems which arise from changes in the scientific basis of our civilization. The disposal of wastes from the nuclear industry, and the tracing of underground waters and transported silt typify research in this field.

4. Environmental problems resulting from increasing urbanization, mechanization, and industrialization in a rapidly expanding population. Most sanitary engineering research deals with the problems of this type. Projects at the University of California include such diverse studies as intrusion of sea water into coastal aquifers; recla-



● FIG. 1. Tracing a detergent through sewage treatment involves a colorimetric estimate of the original concentration and radio assay to determine oxidation of ABS.

mation of water from sewage and industrial wastes by surface spreading, direct ground water recharge, or growing of algae; composting of municipal refuse; treatment of organic industrial wastes; underground movement of pollution; and pollution of the atmosphere by burning fuels.

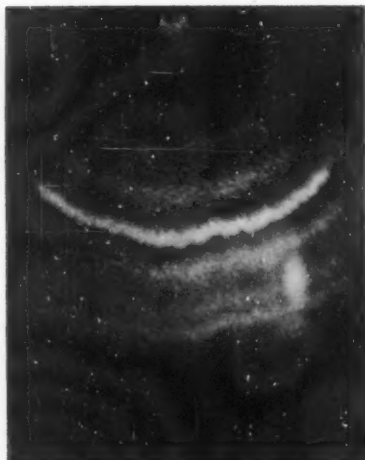
5. Development and modification of methods of chemical, biological, and radiological assay to meet the research needs of the various specific projects.

A brief outline of two of the problems arising from new products, urban development, and scientific change may serve to indicate the nature of research and the significance of the contribution sanitary engineers will be expected to make in the future.

Detergents. Questions concerning the effect of synthetic detergents on water and sewage treatment processes, and of such processes on detergents, recently have made it desirable to re-examine the ability of water and waste treatment plants of conventional design to deal with

present day waste materials. By inference from the surface active properties of detergents, and from an increase in troubles in treatment plant operation paralleling the rise of the use of synthetic detergents in the American household during the past 25 years, there has developed a widespread belief that these products are responsible for frothing of aeration tanks, reduced gas production of digesters, difficulty in water coagulation, and a variety of other problems. It has become important therefore to know to what degree and under what conditions a detergent is destroyed by various sewage treatment processes; how treatment processes can be modified to bring about greater detergent destruction; and the amount of degradation necessary to protect water supplies drawn from receiving waters.

As the answers to these questions became the objectives of research, it became apparent that no one knew how much detergent was in sewage; that methods for its direct measurement were extremely un-



● FIG. 3. Chromatograph of air polluting hydrocarbons produced as a result of inefficient carbonaceous combustion.

reliable; that frothing is not a simple result of adding a surface active agent; and that there is no longer any detergent-free sewage for comparison. Thus the use of a single new product presents simultaneously problems in basic principles, analytical methods, process design, and operational procedures—problems which cannot be ignored indefinitely by sanitary engineers.

The portion of the problem under study at the University of California concerns the ability of various units of a sewage treatment plant to break down alkylbenzenesulfonate (ABS), a chemical which comprises 80 percent of the household detergents presently sold and the process modifications necessary to increase such breakdown.

In this study the amount of detergent initially present in domestic sewage is determined by a colorimetric procedure in which the intensity of color produced by methyl green is proportional to the amount of ABS present. The method is of unpredictable accuracy and of limited value as a research tool under many conditions. Nevertheless it is more accurate than procedures on which is based most of the results reported in the literature, and less laborious and expensive than the precise method of infrared spectrometry of a multiple extracted sample. Research data are obtained with radioactive tracers.

Samples in the separatory funnels in Figure 1 show the color range for various concentrations of (ABS) in domestic sewage. The figure also shows samples being readied for radioassay. Alkylbenzene is sulfonated with S^{35} , a radioactive form of sulfur. This is fed to sewage as it enters a laboratory pilot plant. Sam-

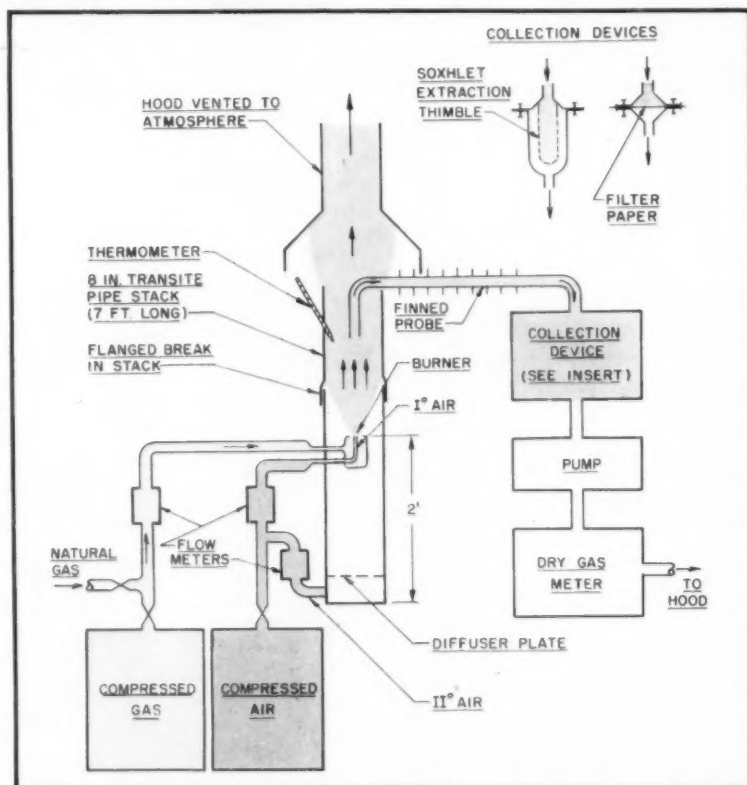
ples of sewage are drawn from various plant units, and the ABS is extracted with ether and adsorbed on carbon. The radioactivity is then counted in a gas-flushed cell operated as a geiger counter. ABS on the solids is alcohol and ether extracted, after the solids have first been radio-assayed in the counting cell by mixing with "Celite." The technique, together with similar procedures, permits a measure of the un-degraded ABS³⁵, as well as the S^{35} coming from the process as intermediate or oxidized products of ABS which no longer have surface active properties.

Results show that an important amount of ABS is destroyed by sewage treatment and indicate that greater reductions may be possible through process changes proposed for investigation.

Air pollution. Possibly more urgent than problems of new products such as detergents, is the matter of atmospheric pollution. Work at the Sanitary Engineering Research Laboratory is presently confined to the basic phenomena of atmospheric pollution resulting from inefficient burning of fuels. Figure 2 shows schematically an apparatus for burning gaseous fuels and extracting the particulate matter formed. With imperfect burning, heavy un-

saturated hydrocarbons are synthesized from even such simple molecules as CH_4 . For identification, these compounds are separated by paper chromatography, in which compounds on a hanging sheet of paper move down distances proportional to their molecular weights, and are compared with chromatographs of known compounds under ultraviolet light. Figure 3 shows a fluorescence pattern of air polluting hydrocarbons separated by paper chromatography. Of some 16 unsaturated hydrocarbons thus far identified as present no matter which carbonaceous fuel is burned inefficiently, three are known to produce cancers in test animals. The relative exposure of humans to these compounds as a result of automobile exhausts, rubbish burning, cigarette smoke, industrial pollutants, or smog is, of course, unknown.

Oxidized compounds, possibly the real "tear jerkers" of smog, are being separated by electrophoresis. In the absence of known compounds of the same nature, however, identification is as yet difficult. The research, nevertheless, indicates that during the coming generation sanitary engineers must play as active a role in air pollution control as they have in water supply and sewage treatment during the past 60 years.



● FIG. 2. Diagram of apparatus for measuring air polluting potential of fuels.

UNIVERSITY of FLORIDA

ADVANCEMENTS in BACTERIOLOGY and ANALYTICAL METHODS

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The extensive sanitary engineering research program underway at the U. of Florida is represented here by descriptions of their projects on the taxonomy and ecology of iron and sulfur bacteria and the quantitative determination of organic nitrogen.

TAXONOMY AND ECOLOGY OF IRON AND SULFUR BACTERIA

THE IRON and sulfur bacteria play an important part in nature and are of considerable importance economically. These organisms are associated with such diverse activities as the formation of boghead iron and sulfur deposits in nature; the tuberculation and pitting of water pipes, as well as slime formation in other water works structures; malfunctioning of certain waste treatment processes; and in stream sanitation. Despite their obvious importance, little is known of their position in the scale of life.

Dr. J. B. Lackey, under a three-year grant from the National Institutes of Health, is attempting to determine the precise taxonomic position of these organisms, in addition to their ecology and nutritional requirements. There is believed to be a possible linkage phylogenetically, of the bacteria and the algae.

Culture media are being developed for the study of various ones of these iron and sulfur bacteria as isolates. Already pure cultures of several, and a number of strains, have been developed. For example, we have twelve different strains of *Sphaerotilus* which are being tested for reactions to trace elements, vitamins, variations in the organic substrate, and in respect to oxygen tension. Morphologic responses to changes in environment are already apparent, and will be helpful in a better classification in forthcoming

editions of Bergey's Manual and Standard Methods for the Examination of Water, Sewage and Industrial Wastes. Field occurrence of various species is under way, and is being correlated with environmental conditions. Already certain environmental limitations have been defined. One highly interesting "sulfuretum", to use the term of Baas-Becking, has been found in Warm Mineral Springs, which contains most of the known species of colorless sulfur bacteria, as well as some of the colored species. The question of whether these naturally occurring populations of sulfur bacteria are the same (in part) as those of sewage treatment processes is under attack. The investigation has already discovered one entirely new genus and species of a sulfur bacterium which closely resembles the oxidizing bacterium, *Zooglea ramigera*, in its general organization.

The project has been fortunate in having had associated with it Dr. E. G. Pringsheim of the University of Gottingen, Germany, for two months as a guest consultant and investigator. Dr. Pringsheim is the foremost European authority on the iron and sulfur organisms, and was very helpful to the study, especially in regard to the isolation of *Beggiatoa*.

QUANTITATIVE DETERMINATION OF ORGANIC NITROGEN

The Kjeldahl method for the determination of nitrogen is applicable to many types of organic compounds. This determination is based upon the reaction in which organic nitrogen is converted to ammonium acid sulfate by means of sulfuric acid and a catalyst. After the ammonia is made alkaline, it is distilled into either boric or sulfuric acid and titrated.

The selection of a proper catalyst and the proper digestion temperature has been the subject of many investigations and reports. Willits,

Ogg, and co-workers^{3, 5, 6}, have shown that mercury is much superior to copper, and they have condemned the use of selenium as a catalyst. These authors, as well as McKenzie and Wallace², have shown that the mercury catalyst, concentration of potassium sulfate, temperature, and time of digestion are the important factors.

The object of this investigation was to determine the feasibility of modifying the Kjeldahl method to make it useful in the analysis of water, sewage, and industrial wastes. Results obtained by this method were compared with those obtained using the method given in the Tenth Edition of *Standard Methods for the Examination of Water, Sewage, and Industrial Wastes*.¹

The first step in evolving this method was to combine the reagents for digestion. A solution combining sulfuric acid, potassium sulfate, and mercuric sulfate was made. Step two consisted of combining sodium hydroxide and sodium thiosulfate. In step three boric acid was combined with a mixed indicator. This mixed indicator proved to be much superior to methyl red for routine analysis. The boric acid solution used to absorb the ammonia was about 0.05M so that the pH at the end point is well within the range of the mixed indicator. Sulfuric acid was used as a titrant since its stability permits large volumes to be made.

To determine the accuracy of the modified Kjeldahl method, a standard amino acid solution was employed. This standard solution contained glycine, valine, cystine, alanine and tryptophan.

The modified method gave 98.47 percent recovery with a deviation from the average of 0.265 percent, which is about 7 percent higher than results obtained by the method in *Standard Methods*. Although 100 percent recovery would be desirable, amino acids of 100 percent purity are difficult to obtain and their hygroscopic properties are marked. Another important factor in these recovery tests was that tryptophan,

the most refractory of amino acids, was used.

Samples of sewage effluent were also used in these recovery tests and gave results equal to those obtained from the standard amino acid solution.

Carbohydrates and lipids usually cause a loss of nitrogen because of the high acid-salt ratio which results from digestion. These interferences were found to be insignificant if excess sulfuric acid was

added to the digestion mixture.

The modified Kjeldahl method has been successfully used in the Sani-

tary Engineering Research Laboratory of the University of Florida since February 1956.

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UNIVERSITY of NORTH CAROLINA

RATES and MECHANISMS of REACTIONS INVOLVING OXY-CHLORO COMPOUNDS

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This research has been supported in part by a grant from the National Science Foundation.

IT IS WELL KNOWN that an unpleasant odor arises when water containing "phenols" is treated with aqueous solutions of chlorine. The word "phenol" is used as a generic term to describe a variety of compounds having substituted hydroxy groups on a benzene ring. In places where the public water supply has been contaminated with industrial effluents containing "phenols," a substitute disinfection agent for aqueous chlorine has been sought. A compound which apparently has disinfecting properties and which does not react with "phenols" to form unpleasant odor-producing compounds is chlorine dioxide (ClO_2). At the present time approximately 100 water plants have used or are attempting to use this compound.

Unfortunately research in the physical and analytical chemistry associated with chlorine dioxide has been limited. This article describes the research on oxy-chloro com-

pounds which is being conducted in the Department of Sanitary Engineering at the University of North Carolina in Chapel Hill.

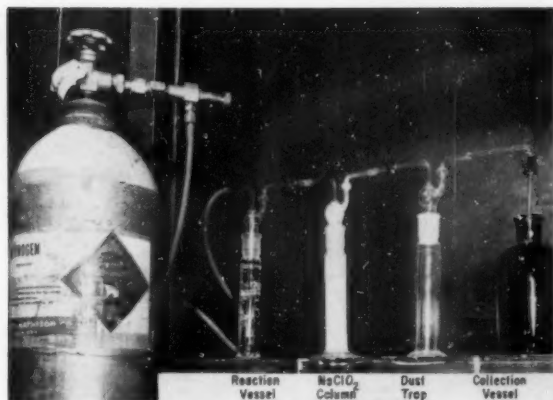
Disproportionation of ClO_2 . It has been observed in the pH range of 11 to 13 that chlorine dioxide (ClO_2) disproportionates to form chlorites (ClO_2^-) and chlorates (ClO_3^-); the overall reaction is described by Equation (1). The rate of reaction under various conditions, the activation energy and the mechanism of the reaction were not known. The determination of these factors has been the purpose of this research.

Chlorine dioxide, a gas, is soluble in water. However, as it is unstable in light in either the gaseous state or in an aqueous solution, it must be produced at the site of use. The generator used is shown in Figure 1. The first cylinder is the reaction vessel, the second contains powdered NaClO_2 to absorb any gaseous chlorine (Cl_2) or volatilized hypochlorous acid (HOCl), the third is an air chamber in which any moisture or carried-over dust could deposit and the fourth container holds water. Either sulfuric acid (H_2SO_4) or potassium persulfate ($\text{K}_2\text{S}_2\text{O}_8$) was placed in the reaction vessel with sodium chlorite (NaClO_2) and the chlorine dioxide generated was swept out of the reaction vessel using dry nitrogen gas. The mixture of chlorine dioxide and nitrogen gases passed through the series of vessels, with the chlorine

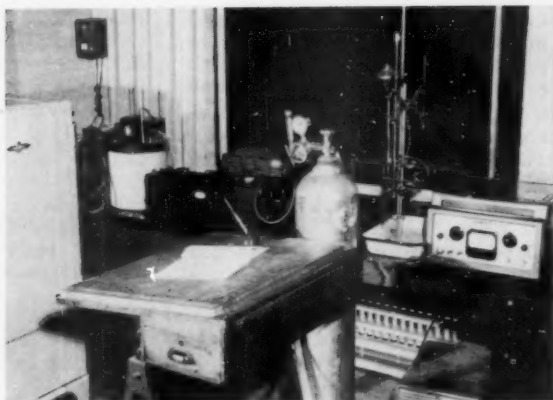
dioxide being dissolved in the water and the nitrogen passing off.

A portion of this chlorine dioxide solution was diluted to desired concentration and predetermined amounts of NaOH (to raise the pH), Na_2CO_3 (for buffer) and Na_2SO_4 (for ionic strength control) were added. The temperature of both solutions was adjusted to a predetermined value. The two solutions were mixed at time zero, and by use of a Beckman DU Spectrophotometer with ultra-violet attachments and temperature control, the reduction in concentrations of chlorine dioxide and the increase in chlorite with time was traced. Figure 2 shows some of the experimental equipment.

From some 50 individual kinetic runs at several values of pH (11.21—11.92 range), at several values of buffer concentration (2.5×10^{-2} to 7.5×10^{-2} molar) and at several values of temperature (9°C — 45.5°C) the effect of these several variables on the rate of the disproportionation reaction was evaluated, the appropriate rate constants were derived and the mechanisms of the reaction were established. The range of initial chlorine concentration used was 2×10^{-4} to 15×10^{-4} molar which is about 34 to 250 mg/l of chlorine dioxide expressed in terms of equivalent chlorine. It was found that the rate of the reaction increases with concentration of chlorine dioxide (a common observation); however the relationship between rate and concentration is not



● FIG. 1. In the laboratory, chlorine dioxide was generated from sodium chlorite. Nitrogen acts only as a carrier.



● FIG. 2. Equipment used in studying reactions included an ultra violet spectrophotometer and visual polarograph.

a simple one. The reaction proceeds by parallel first-order and second-order paths and the equation for the rate of reaction is described in the differential form which is Equation (2). The values of k_1 and k_2 derived for various values of temperature, hydroxyl ion and buffer concentrations are shown in Equations (3) and (4). With Equations (2), (3) and (4) the rate of the disproportionation reaction may be calculated. Large deviations in values of pH, chlorine dioxide concentration and temperature from the experimental conditions might not permit use of these equations.

Experimental evidence indicates that both the first-order and the second-order processes are catalyzed by bases including both the hydroxyl ion and the carbonate ion; the activated intermediate in both processes may be chlorine dioxide-base complexes.

Preparing Chlorine Dioxide. The common method for preparing chlorine dioxide in water plants is the mixing of aqueous solutions of chlorine and sodium chlorite (NaClO_2). The probable reactions taking place, under the conditions commonly used in water plants, are described by Equations (5), (6) and (7). The overall reaction is a combination of these several parallel reactions and the relative degree of importance of each reaction is dependent upon conditions of pH and of relative concentrations of the reactants. A study of these reactions may permit devising more efficient process control measures to insure maximum yield of chlorine dioxide—the desired end product. A study to establish optimum conditions has been undertaken.

The investigation included a study of the reactions at different ratios of hypochlorous acid and

chlorite at various values of pH. The analytical methods included spectrophotometry in the ultra-violet range, to trace with time the formation of chlorine dioxide and the consumption of chlorite and hypochlorous acid. The concentration of chlorides in the end product was determined by reducing all of the oxidizing forms of chlorine compounded except chlorates to chlorides, determining the total chlorides polarographically and subtracting from this value those chlorides obtained by the reduction of the oxidizing compounds. The concentra-

tions of these latter compounds were previously determined spectrophotometrically as described above. The chlorate concentration was obtained by reduction of all oxidizing compounds of chlorine using a Jones Reductor and determining the total chlorides formed. The differences between the chlorides obtained in this step and those obtained in the previous steps are the chlorates. It was observed that a molar ratio of chlorine to chlorites of one to two showed no residual of either chlorine or chlorite. A reduction in this ratio resulted

EQUATIONS REFERRED TO IN THIS PAPER



$$(2) -dc/dt = k_1C + k_2C^2$$

$$(3) k_1 = \left\{ 3 \times 10^7 + 1 \times 10^{10} (\text{OH}^-) \right\} e^{-\frac{14,600}{RT}} + 1.3 \times 10^7 (\text{CO}_3^{2-}) e^{-\frac{24,800}{RT}}$$

$$(4) k_2 = 1.6 \times 10^{11} e^{-\frac{14,600}{RT}} + \left\{ 4.4 \times 10^8 (\text{OH}^-) + 1.3 \times 10^8 (\text{CO}_3^{2-}) \right\} e^{-\frac{7700}{RT}}$$

in which

C = concentration of chlorine dioxide, moles/liter

t = time, minutes.

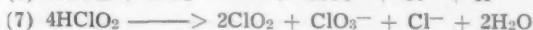
k_1 = reaction velocity coefficient of the first-order process, min^{-1}

k_2 = reaction velocity coefficient of the second-order process, $\text{liters mole}^{-1} \text{ minute}^{-1}$

e = base of napierian logarithms, 2.7128

R = gas constant, 1.987 calories

T = absolute temperature, °K.



in chlorites residual and an increase in the ratio resulted in a chlorine residual. Increasing the chlorine concentration with a fixed concentration of chlorite resulted in an increased rate of reaction.

At a reaction pH of 2 the yield of chlorine dioxide from chlorite was about 70 percent; by increasing the pH to 5 the yield rose to about 85 percent. However, the reaction

was slowed considerably with increase in pH values. It is desirable that the reaction be completed in the generator before introduction of the solution into the water supply. The pH of the reaction solution can be adjusted by the rate of flow of the solution water to the chlorinator.

The rates and mechanisms of the several reactions involving oxy-

chloro compounds have been described and several new analytical methods have been devised. Conditions for optimum generation of chlorine dioxide for water plant use have been established. Further investigation into the chemistry of chlorine dioxide is required and it is planned that this work will continue at the University of North Carolina.

RUTGERS UNIVERSITY

SURFACE REAERATION of WATER as AFFECTED by DOMESTIC SEWAGE

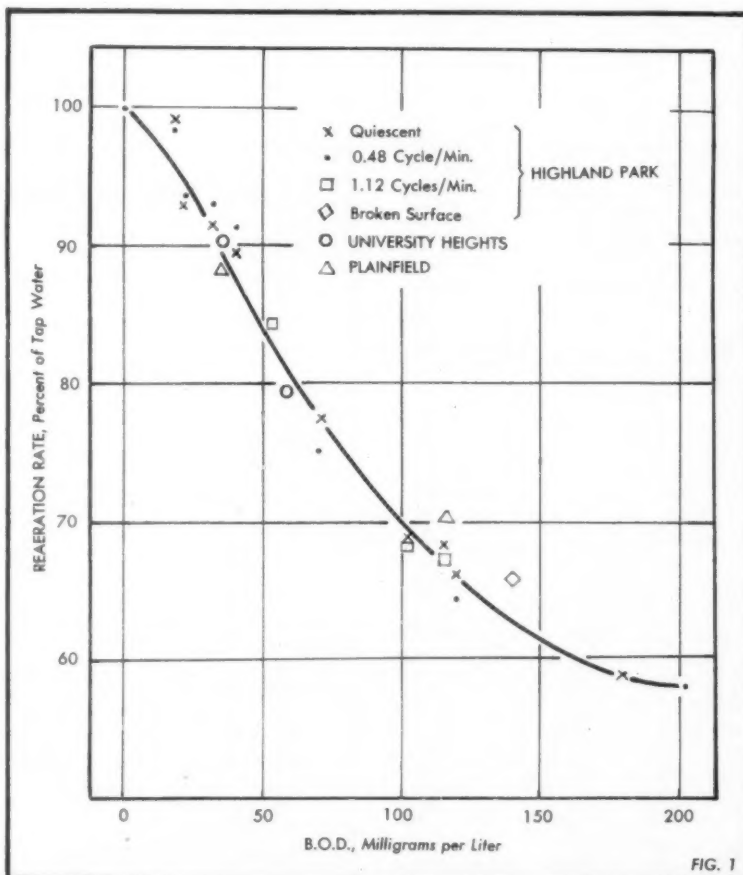
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Department of Sanitation,
Rutgers University¹

SURFACE reaeration rates in water polluted with domestic sewage have been reexamined in a recently completed series of laboratory studies. As expected, domestic sewage was found to cause a decrease in reaeration, and as the pollution becomes heavier, reaeration is more greatly affected. However, the effect of a given level of pollution was found to be considerably less than has been previously reported, provided that biological oxygen utilization is strictly excluded during the experiments. It was found, incidentally, that inhibition of biological activity, to the degree necessary for accurate determination of reaeration rates, requires comparatively drastic conditions, such as high concentrations of chemical toxicants. It is believed, therefore, that the reaeration rates reported from most previous studies involving polluted water are really apparent rates, representing the difference between reaeration and residual biological oxygen utilization.

The apparatus employed for the experiments involving stirring is illustrated in the accompanying photograph. The liquid samples were contained in six lucite cylinders, six inches in diameter and 4½ ft. high. Centered inside each cylinder, a lucite tube 3½ inches in diameter extends from a level one inch above

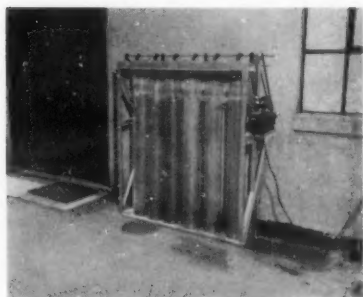
the bottom to a level 3 ft. 11 in. above the bottom. The purpose of the center tubes is to permit obtaining fairly exact knowledge of both the path of travel and the rate of travel of the circulating water.

Without them, there was a marked tendency toward localized circulation around the impeller blades, so that the effective rate of travel of the liquid from top to bottom of a cylinder was indefinite. The impel-



● VARIATION of reaeration rates of water with concentration of domestic sewage.

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● APPARATUS employed consisted of lucite cylinders, each containing an impeller centered in a smaller tube.

lers extend nine inches downward from the tops of the inner tubes. Their rotation rate is adjusted by means of a variable-speed transmission mounted directly on the motor, and by changing the pulley mounted on the horizontal shaft at the top of the apparatus. In operation, each cylinder was filled to a depth of 4 ft. 2 in. requiring a volume of approximately 20.9 liters per cylinder.

Dissolved oxygen was determined polarographically, to avoid the recognized interference of sewage in the Winkler method. Preliminary experimentation established that the course of reaeration in this system

is accurately described by the first-order formula,

$$\frac{dU}{dt} = k_2 \ln U,$$

Where U is the degree of undersaturation expressed as ppm or percentage.

The rate of increase of dissolved oxygen is proportioned to the deficiency. Reaeration rates were observed by determining the dissolved oxygen undersaturation at the beginning and at the end of a measured period of reaeration. The duration of each such observation varied, depending primarily upon the rate of stirring, from one to four days.

Various analytical indices of the degree of pollution were compared with observed reaeration rates to determine whether any one of them was particularly valid as an indicator of the effect upon reaeration to be expected from a given degree of pollution. Since all the analytical criteria vary together when the pollutional concentration is changed, the best indications are obtained from those analyses which are most precise, which vary over the widest ranges, and those in which results are least subject to distortion by

substances other than those to be determined. Of the various analytical procedures observed, the BOD correlated best with the reaeration rate, even though it must bear an indirect, rather than a direct, relationship to the substances present which affect reaeration. With domestic sewage samples from various sources, the same relationship between reaeration and BOD was found to apply. This relationship is shown graphically in Fig. 1.

The graph shows that undiluted domestic sewage of average strength reaerates at about 60 percent of the tap water rate. When domestic sewage constitutes ten percent or less of the total mixture (BOD 20-30 mg), the reaeration rate is not less than 90 percent of the rate in clean, unpolluted water.

The experiments were conducted both in quiescent and in gently stirred systems. In a few experiments, the reaerating liquid was more vigorously agitated. In one case the surface was deliberately broken by special stirring vanes. Over the entire range of stirring rates, and consequent reaeration rates, tested, a given concentration of sewage was found to have the same relative effect upon reaeration as in quiescent systems.

RESEARCH by INDUSTRIES

DORR-OLIVER INCORPORATED

NEW CONCEPTS of SEDIMENTATION

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INVESTIGATION of sedimentation process fundamentals has led to a greater understanding of the factors controlling design of thickening and clarification equipment. Research in the sanitary field has also contributed materially to knowledge of behavior of other widely divergent suspensions such as blast furnace flue dust pulp mill dissolving liquor and concentrated sugar juices. Conversely, results of research in these latter fields has, during the course of the program, provided the answer to problems in sewage clarification and sludge thickening. In effect, the program has been integrated and searching,

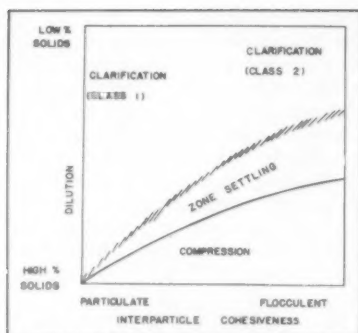
resulting in the evolution of certain basic process concepts.

One of the most extensively employed unit operations in the field of sewage and water treatment, sedimentation is far more complex than the seemingly simple separation of solids from liquids would indicate. In fact, only recently has it begun to emerge from the realm of an art to that of a science. Sedimentation comprises two distinct operations: clarification, in which overflow clarity is of prime importance, and thickening, in which underflow solids concentration is of paramount interest.

For many years clarification and sedimentation basins were designed solely on the basis of experience. As time progressed, research by a number of interested persons re-

sulted in development of a relationship between design variables and certain measurable characteristics of suspensions. The recent Dorr-Oliver research program was a continuation of these basic studies, covering the complete range of solids concentrations from the most dilute suspension to most concentrated sludge. It was also directed toward development, if possible, of certain basic principles applicable to most suspensions.

The program was carried out both at the D-O Westport, Connecticut Laboratories and in the field. At Westport, which has served as Dorr-Oliver worldwide research center since 1917, the work involved, for the most part, development of principles and theory which were later substantiated or rejected by



● FIG. 1. "Paragenesis" diagram.

field testing. Although the first phase of the program, initiated in 1951, has been completed, research continues on other aspects, many of which were suggested by the original work.

It has been found that basically, there are four markedly different manners in which particles settle depending upon dilution of the suspension and their tendency to flocculate or cohere. As particles of each basic type behave differently during settlement, substantially different requirements are placed upon design of the sedimentation basin in each instance.

First of these groups is what has been termed Class 1 Clarification, involving a very dilute suspension of particles which do not coagulate in the settling process (See Figure 1). Each maintains its entity during clarification and subsides at a constant rate determined by its size, shape and density. In this case

only liquid overflow rate controls capacity of a sedimentation unit.

Probably the most familiar group to the sanitary engineer is Class 2 Clarification. Materials of this group exhibit some tendency to flocculate. Organic matter in sewage is a typical example. As flocculation takes place at a definite rate, sufficient time must be provided in the sedimentation basin to complete the process. Also, the overflow rate must be low enough to allow for floccule settlement. Thus, with flocculating particles, design is influenced by detention and, as well, as overflow rate.

The third classification, that of Zone Settling, although relatively new to the sanitary engineer is a most familiar concept to metallurgical and chemical engineers. In this area solids are close enough together to cohere almost immediately into a plastic structure. The ensuing floc subsides through the suspending liquid without pressing on floc layers below, leaving a clear line of demarcation between pulp and liquid above. This type of settling, such as has recently been encountered with

thickness of sewage sludges, imposes a limit on the solids handling capacity of the basin. Consequently, design is influenced solely by the unit area or maximum solids throughput per unit of time.

Final classification is that of Compression in which flocculated particles pile up from the bottom of the basin. Each layer provides partial mechanical support for the layer below. As a result stress is exerted on the floc structure and the pulp is thickened. Factors governing design then become a combination of solids detention and pulp depth.

This research program has served to provide the basic tools which will permit a close approach to optimum design of sedimentation units. A means is available to the engineer to define properly and to classify the particular suspension in question and to evaluate the factors controlling design. Coupling this with application of time-tested laboratory procedures for determining actual values for these factors, he can then accurately size and design a sedimentation unit to fit his particular need.

Table 1—Classification of Settling

Type of Settling	Capacity Controlling Factors
Class 1 Clarification	Liquid Overflow Rate
Class 2 Clarification	Liquid Detention Time and Liquid Overflow Rate
Zone Settling	Solids Throughput/Unit Area/Unit Time
Compression	Solids Detention and Pulp Depth

UNION CARBIDE NUCLEAR COMPANY

EXPERIMENTAL SAND FILTERS for AIRBORNE RADIOACTIVE PARTICULATES

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Union Carbide Nuclear Company
for
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radioactive particulates be allowed to enter the atmosphere.

It has been shown that sand will perform very well as a low cost filter medium for dry air if the air flow through the filter is sufficiently low—0.1 cm/sec. There exists for

dry sand filters an aerosol size for maximum filter penetration. The significance of this is that aerosol particles larger or smaller than the most penetrating aerosol are more effectively removed from the air stream. If a filter is designed to re-

Table 1—Results of Radioactive Particulate Removal

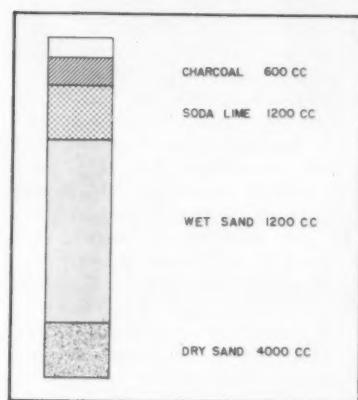
Radioactive Isotope	Percent Activity Evolved	Percent Activity in		
		Condensate	Sand Filter	Scrubber
Iodine	100	80	20	0
Ruthenium	100	90	10	0

THE PURITY of the air is one of the major problems facing the AEC today. The method of ultimate disposal of power reactor waste solutions will require that few or no

move a certain fraction of the most penetrating aerosol, a larger fraction of all other aerosols will be removed. The aerosol size for maximum penetration is 0.35μ (0.35×10^{-4} cm) radius.

These experiments have shown that all sands are not equally efficient as filters. Sands having extremely regular or spherical grains, such as the Ottawa sands, are more efficient than those containing angular grains such as are used for sand blasting. A rough, porous river sand is the most efficient sand tried. The pressure drop through all three types studied was less than 0.1 cm water/ft of sand.

If limestone, shale, and soda ash are added to a highly radioactive

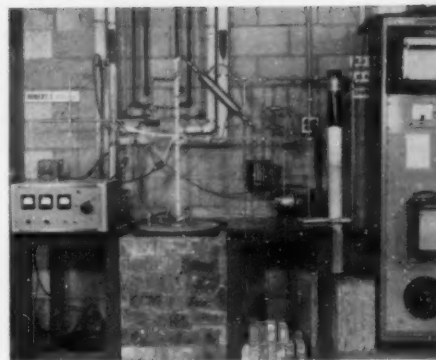


● FIG. 1. Section through the filter.

aluminum nitrate waste solution, the heat of radioactive decay will be sufficient to form a sintered ceramic material. Water, nitrogen oxide fumes, and entrained radioactive particulates will escape as the temperature of the slurry rises. A compound filter developed at the Oak Ridge National Laboratory was designed to remove and retain the water vapor, the radioactive particulates, and the nitrogen oxides evolved from the heated material.

The filter, Figure 1, is a bed of sand (through 20 on 30 mesh) with an area large enough to keep the superficial air velocity below 0.1 cm/sec. The superficial air velocity is defined to be the volumetric flow of the air in liters/sec divided by the cross-sectional area of the filter.

The bed is sufficiently large to contain in the bottom few inches of sand all the moisture which will condense during the life of the filter. The remaining portion of the sand bed is designed to give sufficient depth to remove radioactive particulates to the extent required. The pressure drop is not excessive until the sand filter is completely saturated with water. A smaller volume of sand is required when the equipment is arranged so that the condensed water can drain into a sump below the filter bed. Two absorbents, soda lime and activated carbon, placed on top of the sand prevent the escape of nitrogen



● FIG. 2. Laboratory set-up used, with the filter column next to the recorder.

oxides and iodine. Figure 2 is a photograph of the filter in an experimental set up.

This compound filter has been tested for the removal of radioactive ruthenium and iodine from an aerosol containing water vapor and nitrogen oxides. The air stream contained no ruthenium after passing through the filter. Iodine condensed and resublimed in the sand filter, gradually working its way to the sand-soda lime interface. Table 1 shows the performance of the filter.

On the basis of these data, it is believed that a properly designed compound filter of the type shown above will effectively remove aerosols from either dry or moist gas streams.

MONSANTO CHEMICAL COMPANY

TOXICITY INVESTIGATIONS on AQUATIC and MARINE LIFE

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Monsanto Chemical Company

WHILE the necessity for waste abatement to evaluate properly any specific problem is generally accepted by people in the water pollution abatement field, all too often research into the effects of possible pollutants on the receiving stream is either ignored or overlooked. Population increase and industrial growth with the consequent necessity for stretching our nation's supply of potable water has made it unwise indeed to ignore or overlook this facet of waste abatement in-

vestigation, in which effort must be directed toward determining the toxic effect, if any, on aquatic or marine life.

When a specific abatement problem is encountered in industry today, the progressive manufacturers want to determine these effects for a number of reasons. First, it gives management a goal; second, and equally important, it gives management a control method upon which the efficiency of abatement processes can be checked and controlled. These reasons are in addition to the community relations aspects of the problem.

In an effort to establish a policy of this nature, the Monsanto Chem-

ical Co. has adopted a fully integrated pollution abatement program at one of its plants. In order to maintain the effluent standards established, wastes from new processes must be carefully evaluated. Perhaps one of the major reasons for the very comprehensive waste facilities at this plant is its location, on the Texas Gulf coast with effluent discharge into a tidal bay. This bay is well known for its excellent fishing, and a major recreational industry in the area depends to a great extent on sport fishing.

The problem was first recognized just after World War II when it was decided that one of the waste streams discharging aluminum

Table 1—Toxic Levels of Waste Components Using Pinpearth (*Lagodon rhomboides*)*

Compound	Maximum Concentration At Which No Deaths Occurred, mg/l	Minimum Concentration At Which Deaths Occurred, mg/l	24-Hour Median Tolerance Limit, mg/l	Minimum Concentration Total Deaths mg/l
Hydrogen Cyanide	0.05	0.075	0.069	0.1
Lactonitrile	0.1	0.25	0.215	0.5
Acrylonitrile	20	30	24.5	30
1 Cyano-1,3-Butadiene	50	60	71.5	70
Acetaldehyde	60	70	70	—

*Garrett, J. T. and F. M. Daugherty, Jr., "Toxicity Levels of Hydrocyanic Acid and Some Industrial By-Products," Texas Journal of Science, 3, 391-396 (1951)

chloride might possibly have a deleterious effect on the marine life. One of the local universities was contacted and was employed to study the problem.

Later when the plant was to be expanded, a whole new series of discharge problems faced the plant management, involving effluents containing inorganic and organic cyanides and organic chlorinated compounds. The toxicity of these substances to marine organisms was not available in the literature, and this information was necessary to design extensive waste abatement equipment in a minimum amount of time. On this occasion, it was discovered that the Texas Game and Fish Commission had a marine research laboratory where facilities were available to industry to study problems of this kind. With chemists from the plant research staff and the trained biologists on the marine laboratory staff working in cooperation, the toxicity limits of each of the individual compounds were determined.

Static toxicity tests were made using aquaria containing 30 liters of fresh salt water, with air constantly admitted to the aquaria through stone breaker tips. The toxin was added by pipetting into the aquaria sufficient concentrated material to give a pre-determined concentration. In these tests fish of one species were used to expedite the project. The Texas marine laboratory had previously determined that the specific species used in these tests was intermediate in its tolerance in tests where 10 or 12 species of native marine life were exposed to a series of common industrial toxins. In the first groups of tests conducted for the plant, 24-hour, median tolerance limits were determined by subjecting 10 specimens of the test fish to concentrations ranging from zero to well beyond fatal levels. The specimens were carefully watched for a period of 24 hours with the effects at each concentration recorded.

The data obtained from these tests were used in the design of the waste treatment facilities. Because these materials were cyanides and quite toxic to marine life, one-tenth of the 24-hour median tolerance limit was set as the effluent standard. One year later additional tests were performed using the facilities of the state marine laboratory, in which toxic levels were determined using the same procedure as previously outlined. This time 48-hour median tolerance limits were attempted. The test specimens, however, were not nearly as hardy as they had been during the previous tests due to infestation with a fungus-like disease, and the results were difficult to interpret. It was felt, however, that the lower limit of the toxicity range could be used for effluent limits with reasonable safety. Here again, one-tenth of this lower figure was used for the actual control.

Several years later additional expansion was planned at this plant. This expansion would add several new compounds to the waste streams. By this time it had become a standard operating procedure to obtain toxic limits before discharging any new compounds to the bay.

The tests performed on the waste materials discharged at this plant were short static tests to determine acute toxicity levels; fish were used because they were readily available and because previous work in

the testing laboratory had indicated this specific specimen to be intermediate in its tolerance to chemical toxins and was available throughout the Gulf coast of Texas. To make sure that synergism does not occur in the effluent streams, the plant outfalls are frequently tested using baited fish traps to determine the species and number of marine organisms available. In the years that the plant has operated in this area these fish trap tests have always shown an abundance of all types of marine organisms.

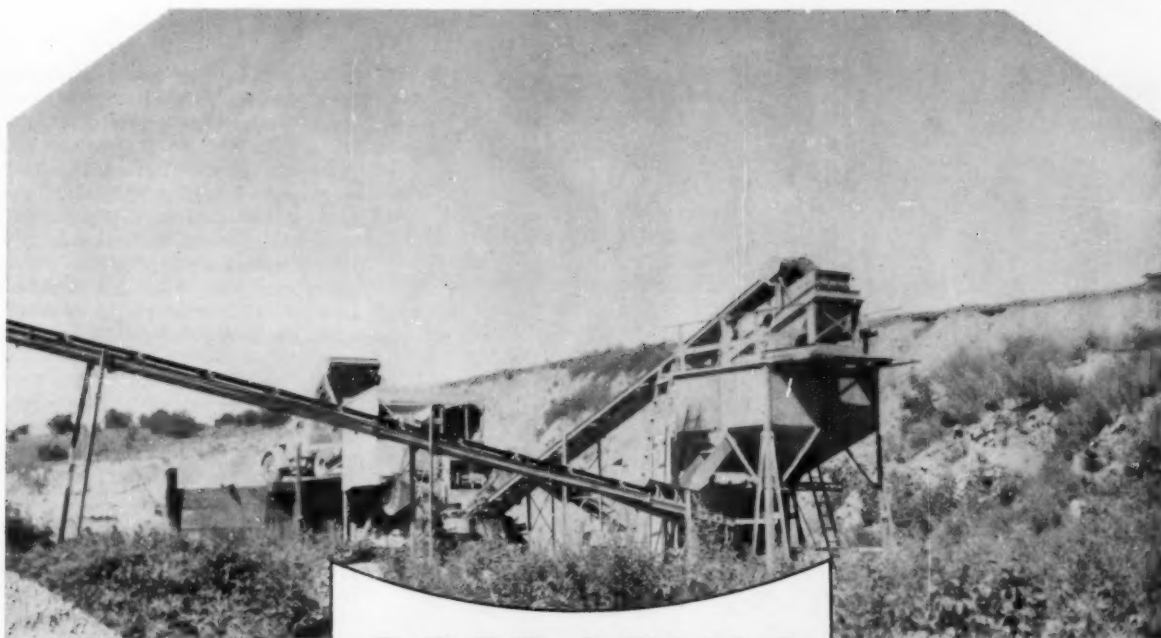
In the case of a fresh water stream into which an industry intends to discharge its waste, much more extensive biological investigation might be necessary before the plant would be assured of not damaging the receiving stream. It is possible to spoil an excellent fishing area through industrial waste discharges by either of two methods. The discharged material can be toxic to the fish life itself or to the lower forms which in turn forces the fish to leave because of lack of adequate food.

It is becoming increasingly important to obtain biological information on a waste problem, and in many cases this information is as important as chemical and engineering data. The fact that many companies have biologists on their waste abatement teams already indicates that industry is stepping in the right direction.

Table 2—Toxicity Levels of Some Chlorinated Solvents* Using Pinpearth (*Lagodon rhomboides*)

Compound	Concentration at Less Than One-Half Deaths, mg/l	Concentration at More Than One-Half Deaths, mg/l
1, 2-Dichloroethane	150	175
1, 1-Dichloroethane	250	275
1, 1, 2-Trichloroethane	150	175
1, 1, 1-Trichloroethane	75	100

* Garrett, J. T., "Toxicity Considerations in Pollution Control," Industrial Wastes, 2, 17-19 (January-February, 1957)



OPERATING

A COUNTY HIGHWAY DEPARTMENT

W. G. HARRINGTON,
Formerly Scott County Engineer,
Davenport, Iowa

SITUATED on the Mississippi River, Davenport, our county seat, is the largest of the "Quint Cities", which comprise a heavy industrial area of considerable diversity. About 17 miles of Scott County's river front is studded with heavy industrial plants which are well serviced by highways, railroads and river barges. The remainder of the Mississippi's flood plain is mostly recreational areas and farm lands.

Moving north and west from the river valley at Davenport, we ascend to the glacial plains and some of the finest agricultural land in the State. The County's 447 square miles are serviced by 97 miles of primary roads under the jurisdiction of the Iowa Highway Commission—all of which converge to a hub at Davenport. This is supplemented by 654 miles of secondary roads under the jurisdiction of the five-man County Board of Supervisors.

Servicing this magnitude of agricultural and industrial interests creates a high percentage of truck traffic on our secondary system. With this situation, our basic prob-

lem is to maintain the roads which have previously been constructed, since we have predominately unstable loam and silt soil types throughout the county. One of my friends put it this way: "Our roads are like old 'cluck-hens'—when they sit down, they spread out all over!" This is typical of what happens to our road embankments, and it is a constant fight to hold the road tops in shape and keep the ditches open.

Our maintenance program is quite flexible. We have eleven maintenance districts, each equipped with a 100 hp. motor grader. A machine of this size allows the operator to do considerable heavy ditching work during the summer. It is well fitted for the occasional heavy snow conditions. Each machine is equipped with a snow plow and snow wing, and scarifiers are also available. Three other motor graders are assigned to either "crew" maintenance or the construction crew as needed. They are also used to supplement the regular maintenance routes during the wet spring period, and are temporarily assigned to the maintenance routes when the regular machines are in for repairs.

In addition to these motor graders, our general maintenance

equipment available includes: two Gradalls; one 1-yd. dragline on crawlers; one 1½-yd. end loader on rubber; one 1-yd. end loader on tracks; two "D" Tournapulls; and two bulldozers.

Using the Equipment

The two Gradalls are in constant demand by all the crews. It is our opinion that their extreme versatility on numerous types of jobs has made them the most popular and outstanding pieces of equipment we own. They were originally purchased for ditch cleaning work, but we have found so many other uses for them, that they have done very little ditch cleaning. Their applications include laying culverts under traffic; removing, cleaning and relaying old culverts; clearing and grubbing in confined and congested areas; channel changes and channel maintenance; repairing and compacting shoulder washouts; excavating adjacent to structures; material handling; stockpile work; repairing tile lines and laying new ones; breaking heavy frost; and excavating frost boils.

The dragline is converted to a shovel during the winter season and is used in the quarry operation to load trucks. The end loaders are



● PURCHASED for ditch cleaning work originally, the Gradalls have proved so useful on many types of work that they are in constant demand by the field crews.

used mainly for stockpile work—though we use them temporarily on a variety of jobs with the several crews. The Tournapulls and dozers handle the earth moving on the larger maintenance jobs, and also work with the construction crews.

Working with this lineup, we have 9 dump trucks of the 25,000 GVW class. They are assigned to the crews as required. The remainder of the time they haul resurfacing material and are under the direction of the truck foreman.

The bridge crew takes care of the 191 bridges and the larger box and pipe culvert maintenance. They have two specialized trucks for this purpose. One has a four wheel drive and is used on snow removal during the winter as needed. This crew is also used for the "odd job" work around the Court House, shop and maintainer sheds.

We have approximately 75 old wooden bridges of less than 24-ft. span in the County. Many of these

have drainage areas small enough to be handled by pipe or arch culverts. Consequently, when one of these structures requires major repairs, we often replace it with a pipe or arch culvert which practically eliminates the future maintenance problem.

Erosion control is one of our vital interests. We have an active policy of cooperating with the farmers and the Soil Conservation Service in constructing drop inlets on our culverts, and other specialized structures which will reduce erosion. The bridge crew does this type of construction work.

The construction crew has five tractors with 8 to 11-cy. scrapers; two "D" Tournapulls; two bulldozers; two pull type blades; an elevating grader; rollers; and other equipment as needed. Our State Laws prescribe that: "All contracts for road or bridge construction work and materials therefor, of which the engineer's estimate exceeds

\$5,000, except surfacing materials obtained from local pits or quarries, shall be advertised and let at a public letting." When the prices are good, we award the work to the contractors, but occasionally the bids are rejected for being unreasonably high, and then we do the jobs with our own crew. This work, along with jobs under the financial limits, usually amounts to 10 to 15 miles per year.

Quarry and Shops

Our County quarry is also operated by our construction crew, but only during the winter and spring seasons. This produces up to 70,000 tons of crushed rock per year, which is hauled by our own trucks. Our production cost per ton is relatively high, but still is 5¢ to 15¢ per ton less than what we must pay at the commercial quarries. The quarry serves two other purposes, however. First, we can justify keeping our experienced grading personnel all the year; and secondly, we always have a crew of experienced men available to assist the maintenance men during snow or other emergencies.

One centrally located shop, about ten miles north of Davenport, is the hub of all crew activities. The chief mechanic directs all equipment maintenance and repairs, operating from the shop. He does all the parts purchasing with the aid of the shop clerk on a shop order type system. The shop orders are brought to the County Engineer's Office in Davenport each morning and requisitions are issued for the suppliers. Since the major suppliers are within the city, the chief mechanic takes the requisitions and "makes the rounds" picking up the supplies and parts. He can check the parts as he gets them, thereby making sure they are the ones wanted. This system also gives the office absolute control of the operating costs of each machine. All parts used from stock are dispensed by the clerk, and once a month his records are sent to the office for posting in the operating cost records. His inventories are adjusted daily as supplies arrive or are dispensed. Material supplies are handled in the same manner under the Maintenance Foreman's jurisdiction.

Field Operations

The basic survey crew comprises 6 men. They occasionally work in two crews. We can add 4 more experienced men to the crew at any time if needed, though they are normally assigned to other work.

During the summer, we employ an additional 4 or 5 college students—who incidentally usually come back each year until they graduate.

The party chief doesn't actually spend much time with the crew, but directs their work and issues instructions each morning. His assistants take charge the remainder of the day.

Perhaps this procedure seems strange, but beginning this year, we assigned him to the biggest single obstacle in our construction program—Right-of-Way acquisition. Practically every road in our Secondary Construction Program or the Farm-to-Market Program requires additional right-of-way to be acquired. The party chief makes the contacts accompanied by at least one member of the Board of Supervisors. This assures the Board that their policies are being carried out and that no unauthorized statements or promises are made "just to get signatures." We find that this year we are spending as much time acquiring right-of-way as we do on design. The days of donating land to get an all weather road are a thing of the past.

We have three technicians in the office doing detail design under the direct supervision of the Engineer. These men can be shuttled to the survey crew, materials inspection or construction inspection as the needs arise. The Chief Inspector notifies the Engineer when and where he needs assistance, and within 30 minutes, a man can be on the job in any part of the county.

The party chief, technicians, chief inspector and survey crew have been given every opportunity to advance in their specialties through State conducted short courses and with occasional "sessions" conducted in the office. We also try to give them the utmost of variety in their work and when possible work with other phases of the program so they can broaden their scope. This has developed a versatility of experience which has proven to be very beneficial to the county, since the personnel can be assigned or reassigned to jobs as any particular need or rush job arises.

The office staff consists of the engineer, two assistant engineers, an administrative clerk and a bookkeeper.

All work and the coordination of the crews is directed by the Engineer and his two assistants. The foremen in turn handle all detail direction of work and keep the Engineer and assistants advised of the progress. We are in constant

touch with each other by means of a two-way radio system. Our radio set-up consists of two base stations—one at the office and one at the central shop, seven mobile units and two walkie-talkies. The mobile units are installed in the automobiles of the County Engineer, assistant engineer, survey crew, truck foreman, chief mechanic, maintenance foreman and grading foreman. The walkie-talkies are used mostly by the survey crews and inspectors. The radios have had a tremendous "streamlining" influence on the efficiency of our work.

Advantages of Radio

The great advantage of the radio system is that we can contact each other at any time we wish. When a complaint comes in, we can often take care of it the same day by being able to let the men know about the job. Breakdowns can be reported immediately, and parts can be ordered and a mechanic dispatched within minutes. Crews encountering unforeseen difficulties and problems can call in for advice or additional instructions, and often lose only 5 or 10 minutes where formerly delays of an hour or more would be experienced. The survey crews can call in for ties to monuments and corners, or other information they may need. They also use the walkie-talkies to advantage when they are beyond normal shouting distance of each other. The contractors are very happy about our radios also. Inspectors, survey crews and materials can be sent to their jobs with little or no loss of time; and ready-mix concrete timing can be handled almost within minutes of when it is needed. In case of emergencies, the necessary crews and equipment can be dispatched in minutes.

Another advantage is the big reduction in the many wasted hours of driving time, which can now be utilized for greater productive use. Also the actual miles driven has been reduced as much as 50 per-

cent on an average; and on the engineers cars, about 65 percent. The monetary savings in operating costs of the vehicles alone, since the radios have been in use, have more than paid for the initial cost and subsequent maintenance of the radio system.

The Board of Supervisors are elected at large and serve at large. They determine all policies, which the county engineer is held responsible for administering. Three of the five members are appointed to the Road Committee. The Chairman of the road committee is the closest contact we have between the Board and the engineer. He will call official, as well as informal, meetings whenever it is deemed necessary. We try to have at least one "information chat" with the Board members each week—either collectively or individually. During these sessions we discuss the work of the past week, the present week and the next week's plans; and we also discuss any situations we know will be coming up for decisions in the near future. Each quarter we explain to the Board our expenditures and how they compare with our budget. Our combined road and bridge funds total approximately \$1,000,000 annually.

The Iowa Highway Commission has an excellent policy of cooperation with the Counties in matters of planning and technical advice. Standard designs for culverts and bridges are available for many sizes and types. Special designs are made in this office when necessary. It is required that the Highway Commission approve all plans for construction work; and on Farm-to-Market work they make final acceptance of a project.

In general, the operation of Scott County is a cooperative and joint effort from the Board of Supervisors to the road crews, and due to this relationship, we feel we are getting the maximum amount of work and benefit for the tax payers dollar.



● COUNTY-owned equipment is maintained in sufficient amount to do many jobs on which bids are high. Here a "D" Tournapull and a dozer are opening up a new cut.



● A WELCOME sign for travelers.

FRANKLIN T. ROSE,

Landscape Architect,

State Highway Commission of Kansas

THE POPULARITY of roadside parks has increased tremendously since the close of World War II. Increased tourist travel with more and more tourists using such facilities, plus a desire on the part of highway engineers to provide this highway service, has helped develop this popularity. Many service clubs and other organizations, many public officials, safety engineers, and others have urged the building of roadside parks. Fred Burggraf, Director of the Highway Research Board, comments: "These rest areas afford the traveler an opportunity to get away from the hurry of the highway for a brief period. They are places to rest, eat lunch, enjoy the natural scenery, and then go on your way refreshed. Just how many accidents have thus been prevented it would be hard to say, but it is logical to assume that without a convenient place to stop for a rest, many motorists, though drowsy, would continue their driving."

The terms roadside rest area, roadside turnout, roadside park, wayside, and picnic area turnout are used interchangeably by many people. Reduced to the simplest definition, these terms are intended to describe a small roadside area served with a drive and parking facilities. The area is usually provided with shade, toilets, drinking water, picnic fireplaces, and picnic tables. The majority of the states that provide these service areas call them roadside parks.

The first roadside park in Kansas was built in April, 1934, in a two-acre wooded area. Four picnic

Design and MAINTENANCE of Roadside PARKS



ROADSIDE PARK REGISTRATION

Name: *Mr. & Mrs. Virgil L. Long* No. in Party: *2* Date: *6/8/57*
 Address: *1630 Canella St.* City: *Berkeley* State: *Calif.*
 Destination: *To Kansas City Mo.* From: *Berkeley Calif.*
 Comments: *After continuous driving from Salt Lake City Utah, the accommodations we found here at your roadside park were welcomed with open arms. The area is very nice. Thank you so very much.*

Form No. 111 State Highway Commission of Kansas

tables, two fireplaces, two toilets, a turnout drive and parking area were provided. Each year since 1934 (with the exception of the war years) the State Highway Commission has built additional roadside parks. Kansas now has 125 roadside parks and 60 picnic table sites. A picnic table site is a place where cars pull off the highway to park under a shade tree. A trash barrel and one or two picnic tables are installed only at locations where automobiles can enter and leave the highway with safety.

Increased tourist traffic since the close of World War II has stimulated the building of these service areas. Out-of-state motorists expect to find rest areas in the states in which they are vacationing. Thousands of tourists have praised the manner in which Kansas is maintaining roadside park facilities. State Highway Engineer Walter

● PICNIC facilities at a roadside park, and registration slip collected from visitor.

Johnson has commented that "the building of one good roadside park creates good will and more favorable comment from motorists than the building of several miles of modern highway".

Selecting the Site

Location is an important factor in selecting the roadside park site. Out-of-state tourists have shown a preference for rest and picnic areas outside the cities. A park site some distance (five miles or more) from a city or town is easier to maintain.

More papers, cartons, cans, bottles, and other debris are scattered in roadside parks adjacent to large towns and cities than in parks some distance from a town. All this debris must be picked up and carried

away by maintenance men. Some city dwellers place trash and even garbage in paper sacks and toss this refuse into the roadside park trash cans. There are some people who just toss their litter onto the highway shoulder. Very little debris of this nature is left by city dwellers in parks located several miles from the cities.

Although park locations some distance from towns are usually preferred, this rule is not always followed. In the Plains area of Western Kansas both water and shade are limiting factors. In order to secure water, a number of park areas are located adjacent to small towns. City water is made available to water trees planted in the park area as well as to supply drinking water to motorists. Since shade is an important item, two shelter houses are built with two picnic tables placed in each. In Eastern Kansas, wooded areas are selected and wells

TRANSE. The majority of Kansas roadside parks have two entrances (or exits) spaced 300 to 450 ft. apart.

Designing the Park

Areas for roadside parks have been secured by purchase and by donation. Many of the early parks were built on wide pieces of right-of-way. These were sometimes irregular-shaped areas where a new alignment digressed from the old route. Occasionally a portion of the old pavement could be used for the turnout drive and parking area. These areas would vary in size from half an acre to four or five acres. A number of desirable areas were secured during highway widening or when securing right-of-way for a new highway alignment. The purchase of two or more acres of land when other right-of-way is being secured will provide the necessary area. Individuals have

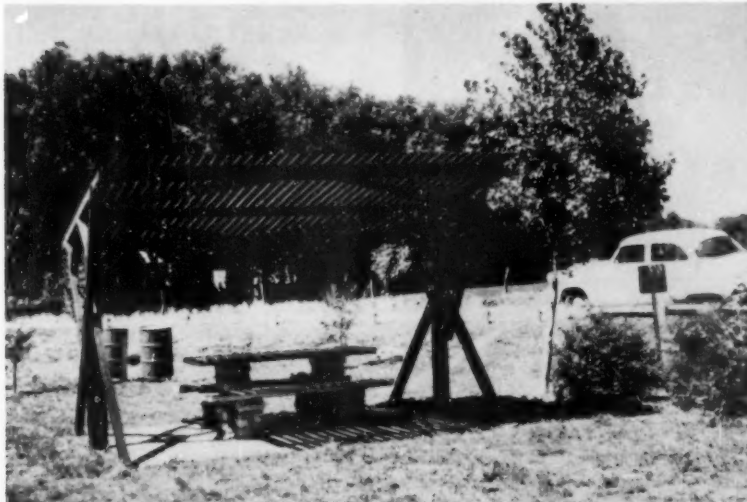
physical features of the area will influence the location of the parking area and other facilities. Shelter houses or picnic shelters are essential where there is an absence of shade trees. This item may be deleted in roadside parks where good shade trees are growing. Other essential park facilities include: (1) picnic tables; (2) picnic fireplaces or grills; (3) toilets; (4) drinking water; (5) guide posts or guard fence; (6) property line fences; (7) roadside park signs; (8) walks, surface paths, and stepping stones; and (9) landscape treatment of the roadside park. Landscape treatment consists of seeding and sodding to check soil erosion and to enhance the beauty and utility of the area, planting of trees to provide shade, and planting of shrubs to enclose portions of the area, to screen out undesirable views, and to provide partial barriers between picnic areas, drives, toilets, etc. In the Central Great Plains area, a shelter belt or windbreak planting along the boundary of the roadside park is desirable and can be satisfactorily grown if the plants are watered during drought periods.

Drives and Parking Areas

Where sight distance, topography and other features of the area permit, two entrances should be built. Entrances should be a minimum of 36 feet wide and should be spaced 350 to 500 feet apart. On rural highways carrying two lanes of traffic the entrances may also be used as exits. Motorists who do not have time to slow down for the first entrance may use the surfaced shoulder for deceleration and thus be able to enter the second entrance with ease and safety. The park drive may parallel the highway, being separated by a long narrow traffic island. The traffic island may vary in width from a few feet to 100 feet or more. The traffic island, sometimes called a safety island, greatly increases traffic safety by channelizing entrance and exit of vehicles to two locations.

Some of the early roadside parks had narrow, skimpy drives. Where space permitted, a number of drives have been widened. Today's standard design calls for a 20 to 22-ft. surfaced drive, graded to a 6-in. crown. Guide posts or guard fences are placed along the edge of the drive, along parking areas and at other locations where drivers are likely to drive onto the lawn or picnic areas.

The parking area should be large enough to serve the number and



● PICNIC table of concrete is shown in park along US 40 near Central. Note the slatted roof to reduce discomfort from sun and drums in rear for waste disposal.

are drilled to provide drinking water.

Good sight distance is one of the chief prerequisites. In this day of fast travel it is imperative that cars have ample time to slow down to enter the park drive. Advance warning signs help to accomplish safe entrance into the parks. Three signs are used to warn and guide the motorists. A 24 in. x 30 in. metal sign with 5 in. black letters on white background reads: **ROADSIDE PARK 1 MILE**. The next sign carries a directional arrow pointing either right or left. Above the arrow are 5 in. black letters which read: **ROADSIDE PARK 1000 FEET**. The third sign placed at the entrance reads: **PARK EN-**

donated several fine sites and cities have provided sites in a few instances.

Having secured a suitable site, detailed landscape plans are prepared. The first step is to locate important items, such as ditches, utility poles and existing trees, in the park site and between the park site and the highway. Usually a survey of the site is necessary in order to plot contour lines and to locate the trees and other items. From the contour map the grade lines for the park drive, park drive ditches, and parking area can be designed. A paced survey is often sufficient in the Plains area where the topography is almost level.

The topography, trees, and other

kind of vehicles that will use the area. Many of the early roadside parks in Kansas provided parking for only 3, 4 or 5 touring cars. Some of these parking areas have been enlarged and others need to be expanded.

Although the early roadside parks were built primarily to serve tourists and local citizens, truckers also frequent these rest stops. Safety engineers urge drivers to stop and relax when they are tired and drowsy. Each year an increasing number of truck drivers use the roadside parks. A tired driver may pull into the parking area, use the toilet, and then stay for a two or three-hour rest. He usually curls up in the cab and sleeps, unaware of other vehicles that drive in and out of the parking area. In a small park, one large semi-trailer truck may occupy nearly all of the parking area. The modern roadside park must be designed to include parking for several trucks, or separate truck parking areas should be provided.

Maintaining Roadside Parks

If the areas are to serve the traveling public in the manner intended, they must have good maintenance. Untidy areas are a reflection upon the Highway Department and the State. Each roadside park must be checked regularly to see that all park facilities are in order. Conrad L. Wirth, Director of the National Park Services, says: "Rest areas pose a problem with us just as every public facility does. Proper maintenance and policing require both well-trained maintenance crews and public co-operation. Lack of these is a sure way to lose friends for a park department. I'm sure the same would be true of a highway department".

The degree of park cleanliness and the method of maintaining this service rests primarily with the top ranking officials in the various highway departments. Each state makes its own rules and regulations as to what highway services they will provide and how well they will handle these services. A number of states have excellent roadside parks and have developed a uniform method of maintaining them. Kansas meets the maintenance problem in a realistic way. Chief Maintenance Engineer, L. J. Siler, takes a positive stand that the roadside parks shall be given good maintenance, and this philosophy guides the thinking and action of others in responsible charge.

Since the areas vary in size, vary in the number of facilities provided

and the number of people served, there is also a variation in the kind and amount of work required for good maintenance. Following are items that are covered in directions to attendants:

1. Empty trash cans. Perform this task daily in some parks, two or three times a week in others, as indicated.
2. Check toilets a minimum of three times weekly. Wash toilet seats with soapy water followed with a disinfectant. Replenish toilet paper and sanitary seat covers. Spray for fly control.



● SPONSOR'S sign is placed in each park where a local club will help to beautify or supervise the park property.

3. Pick up papers, cans, and any other debris that might be left in or near the park area.
4. Replenish firewood when supply is low. Replenish registration pads in the parks where registration boxes are installed.
5. Mow grass, cut weeds, take care of trees and shrubs. Spray for insect and plant diseases, fertilize, cultivate, prune, etc.
6. Fill or patch rough places in park drive and parking area. Straighten guide posts when needed.
7. Check water well and pump to replace worn pump leathers. Collect water samples each month for testing by the State Board of Health.
8. Paint picnic tables, toilets, guide posts and sign posts yearly or when needed. Make minor repairs to fire-place, tables, and other structures when needed.
9. Make improvements by enlarging parking areas, improving table sites, improving the drainage along

park drives, placing additional surfacing material on drives and on paths.

Maintenance is most economically handled by a Division Landscape crew. This crew makes periodic trips to each park to mow grass, furnish supplies, and make necessary repairs. The items of work needing attention two or three times a week can be handled by a local caretaker. This person may work 20 to 30 hours a month depending upon the number of facilities in the area. Kansas has a number of part-time caretakers who do certain items of park clean-up work on a contract basis.

Safety Turnouts on the Interstate System

The spotlight is on the 1956 Federal-Aid Highway Act which sets forth the rules that will govern the building of the Interstate System. The highest standards of design, construction, and safety are being planned for these limited access highways. Safety Turnouts will be provided for in the initial planning stage.

The term 'Safety Turnouts and Rest Areas' describes the function of the service areas that will be built on the Kansas Interstate System. They will be just what the term implies. The same degree of safety will be built into park entrances and exits that are designed for Diamond interchanges. Deceleration lanes and acceleration lanes will be built as set forth in the AASHO "Policy on Geometric Design of Rural Highways".

In a letter to the seven states of this region, W. V. Buck, Regional Engineer, Bureau of Public Roads, Kansas City, Missouri, advises: "Roadside rest areas along the modern highway are popular with the motorists as they provide the necessary services for rest and relaxation, which is an important element in highway safety. We feel that rest areas are going to be essential along the Interstate System."

The policies for locating and building rest areas on the Kansas Interstate System will be practically the same as those adopted by the states of Ohio and Oregon. Principal items of this policy which were issued by State Highway Engineer, Walter Johnson, are as follows:

1. Safety turnouts and rest areas are considered to be part of the over-all design of the interstate system and shall be included in the initial design.
2. The spacing of safety turnouts

(Continued on page 136)

HOW A CITY CUT WATER BILLING COSTS

PHIL HIRSCH

THROUGH USE of machine accounting methods and a cyclical billing system, Palatine, Ill., a Chicago suburb, has cut the clerical costs involved in preparation of its water bills by more than \$1200 a year. Previously, an outside statistical tabulating firm computed the water bills each quarter, and charged Palatine \$1200 annually for the service, reports Village Manager Warren C. Kohler. Now the job is done by village clerical personnel, with the aid of a model 3100 accounting machine manufactured by National Cash Register Co. Each bill still covers three months of water consumption, but instead of preparing notices for all of the village's 2400 water customers at the same time, one-third of the statements are prepared and mailed each month.

Cost of the new accounting machine, acquired about a year ago, came to approximately \$5,500. In other words, by eliminating the \$1200 yearly charge for outside accounting service, this investment should pay for itself in approximately four more years.

Significantly, Palatine did not have to enlarge its clerical staff after acquiring the machine and taking over the water billing chore. Basi-



● **MACHINE** is also used to post water service payments to accounts. Data are recorded on ledger cards which are better storage media than bill copies were.

cally, this was because certain manual steps formerly involved in the billing operation were either handled by the machine or eliminated altogether.

Besides cutting costs, another benefit of the new arrangement is a reduction in overall water bill processing time. According to Manager Kohler, statements are now put in the mail as much as 10 days sooner than was possible before.

The NCR machine isn't used solely for water billing and posting operations. The village also uses it for recording all of its other receipts—such as charges for building permits, parking fines and vehicle and dog license fees. Also, all disbursements of village funds—in-

cluding payroll—are processed in the same fashion. This accounting work was done previously by hand. Exact figures aren't available, but Mr. Kohler estimates that the time and cost savings produced by elimination of the manual labor involved in these latter accounting chores are almost equal to those stemming from the new mechanized water billing system.

Water billing operations—preparing 800 postcard-size notices every month, and recording payments as they come in on ledger sheets—take up about 60 percent of the NCR machine's total operating time, Manager Kohler adds. The remaining 40 percent is devoted to processing the other accounts.

CONSUMER'S RECORD				OFFICE STUB PALATINE, ILLINOIS WATER & SEWER DEPARTMENTS 10M 5-56 36856 6
Village of Palatine, Illinois 54 S. BROCKWAY STREET WATER & SEWER DEPARTMENTS				
DATE	METER READINGS		100 CU. FT. USED	
	PREVIOUS	PRESENT		
				TOTAL BILL
WATER	SEWER	ARREARS	TOTAL BILL	TOTAL BILL
PAYABLE WITHIN 30 DAYS FROM DATE OF BILL				INSTRUCTIONS RETURN THIS STUB WITH PAYMENT
PAY PROMPTLY AND AVOID PENALTY				

● **POST-CARD** notice used for billing the 2400 customers, one-third every month.

Palatine's quarterly water bill includes charges both for water and for sewerage service. Approximately eight years ago, the village built a new sewage treatment plant. This was financed by a bond issue that is being repaid by a quarterly assessment against each water user. The charge for each of the two summer quarters is \$2.50 per account. In the winter, the assessment for each three-month period is based on the amount of water consumed. Charges are: 25 cents/100 cu. ft. for the first 2,000 cu. ft. of water used per quarter; 20 cents/100 cu. ft. for the next 2,000 cu. ft.; 15 cents/100 cu. ft. for the next 4,000 cu. ft., and 10 cents/100 cu. ft. for all quantities in excess of 8,000 cu. ft. These rates apply only within village corporate limits; users living outside the village pay 15 to 20 cents additional per 100 cu. ft. within each of the above categories.

Water rates start at 35 cents/100 cu. ft. for the first 1,000 cu. ft. consumed. For the next 2,000 cu. ft., the fee is 30 cents/100 cu. ft. The rate drops to 24 cents/100 cu. ft. for the next 5,000 cu. ft., and to 16 cents/100 cu. ft. for all consumption over 17,000 cu. ft. The rate beyond corporate limits ranges from 52.5 to 36 cents/100 cu. ft.

Data on Each Bill

Each water-sewer bill contains either seven or eight items of information: The date; previous and present meter readings; the number of cubic feet used; the water charge; the sewerage charge; and the total charge; also, in some cases, an unpaid balance from the previous bill.

The date is punched into the NCR machine at the beginning of the billing operation. The number of cubic feet of water used by each customer, and the total water-sewerage bill, are computed automatically. All the machine operator must do to prepare each bill is add these items of variable information: the previous and present meter readings, the water charge, sewerage charge, and arrears (if any).

The meter data comes from a meter reader's book, which the biller has in front of her as she operates the machine. Water and sewerage charges are taken from previously-prepared tables which show the fees to be charged for any given quantity of water consumed. Arrears are listed on a ledger sheet containing each customer's past record of charges and payments.

Prior to going through the NCR machine, the postcard bill is ad-

dressed semiautomatically with the aid of an addressograph machine and a set of metal plates showing each customer's name and address. Thus, when the billing job is completed, the card is ready to be mailed.

Under the previous system, water billing operations consumed almost as much clerical time at village hall as they do now, despite the fact that an outside agency computed and printed each statement. Primarily this was because the village hall clerical staff had to enter manually the two meter readings, obtained from the meter reader's book, on tabulating cards. These cards were then put through a keypunch machine by the outside tabulating firm, and afterward were used to prepare the postcard water bills.

The tabulating firm, located in Chicago, required about a week to process the bills. A village official then had to drive to the city, and pick them up, a round trip of some 50 miles. As a result of doing part of the water billing job themselves and farming the rest out, Palatine officials seldom were able to mail statements before the 25th.

Under the new system, because fewer bills are processed at a time (800 each month instead of 2400 every quarter), and because the processing procedure has been streamlined and more highly mechanized, the bills are almost always in the mail by the 15th.

Besides increasing the efficiency of the water-billing operation, Palatine's new accounting machine also has made it possible to set up a new

and more efficient record system for water bill payments. Now, as payments come in, they are posted to a ledger sheet, mentioned above, which has enough space to list the charges, as well as the payments, for each account for more than a year back. Previously, the record of each customer's account was kept on a series of postcard-size paper sheets. These sheets, stapled to the postcard bill when it was sent out, were returned with the payment and then were filed, to serve as a ledger.

By using one ledger card, in place of several small paper sheets, it is much easier to get information on a given account out of the file if, for example, a village resident calls requesting information on his bill. Preparation of bills involving unpaid balances is also expedited.

Meanwhile, the cost of bill forms has been cut as well. For now, all that has to be sent to the user is a postcard, which has a perforated stub that is torn off and returned with the payment. The need for using a three sheet form—consisting of postcard, white copy, and carbon paper—has been eliminated. Manager Kohler estimates that as result of this simplification, the investment in forms has been cut by approximately 25 percent.

Only about a week was required to familiarize village clerical personnel with operation of the new accounting machine, he adds. This is considered particularly noteworthy since personnel had no previous experience with such machines.

Sanitary Landfill Operations in Auburn, New York



● THE OPERATOR of this International Drott TD-18 4-in-1 places, compacts and covers an estimated 200 yds. of refuse in a 7-hour shift. The City of Auburn, New York, converted this 75-acre fill site to the sanitary fill method in April, 1957.

SUBSURFACE EXPLORATION with the A-G SOIL PENETROMETER

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Department of Geology,
Syracuse University,
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SUBSURFACE exploration programs are influenced by a number of factors, such as the size and type of project, general character of soils in the area of work, and the time available for the investigation. A relatively small project such as a light one-story building does not justify economically an extensive soil exploration program which would involve a large expenditure. Also, an elaborate exploration program consisting of considerable field and laboratory investigations would not be justified on sites where the subsoil conditions are erratic. For the latter case, strategically located drill holes with intermediate subsurface soundings would provide sufficient information for site appraisal and foundation purposes. This would result in economies in both expenditures and time with respect to field investigations.

Subsurface soundings have been used for many years to determine the consistency of cohesive soils and the relative density of cohesionless materials. This method of investigating subsoil conditions is based on measuring the resistance of the soil against penetration of a device known as a penetrometer and may be accomplished by dynamic or static penetration tests.

The most widely used penetration test in the U. S. A. is the so-called standard (dynamic) penetration test which consists of a 2-inch outside diameter sampling spoon of 1½-inch inside diameter driven under an



● **IN THE FIELD,** the 35-pound hammer can be handled easily by one man.

energy of 350 ft.-lb. into the ground at the bottom of a drill hole. This energy is generally realized by using a weight of 140 lbs. with a drop of 30 inches and the number of blows per foot is recorded as penetration resistance.¹ The standard penetration test is widely used for estimating bearing capacities of soils for relatively small projects. This method is fairly reliable in sandy soils but is little more than a crude approximation in clayey soils.

It is generally recommended in reports on subsurface investigations that all excavations for shallow foundation purposes be inspected by some type of probing to insure that no loose or soft material exists. This has been accomplished by driving a rod or bar for a few feet into the soil at the elevation of the proposed foundation footing and estimating the soil density from the number of

blows required to drive the rod 1 foot. To maintain a constant energy per blow, Frank N. Kneass, a Philadelphia engineer, developed the Kneass Drop Penetration Test.² Kneass began testing soils down to a depth of 4 feet by driving a 1-inch solid steel rod with a 25-lb. hammer dropped from a 36-inch height. The hammer has a hole in its center so that it can slide freely on an upper rod until it hits a flange welded to the lower or driving rod. The 25-lb. hammer can easily be handled by one man. When the soil is found very soft or loose at a 4-foot depth, a longer rod may be used to sound to greater depths.

The Apfel-Goodman penetrometer was developed originally to sound between boring locations and to probe excavations for footing foundation purposes. The penetration test is dynamic in nature, consisting of a 35-pound weight falling 30 inches to drive a rod and recording the blows per foot for several feet or more of penetration. It can be noted that the driving energy is one-fourth that of the standard penetration test. The weight can be handled by one man. The driving rod can be either standard A or E-rod with a solid drive end or an A-rod with a standard sampling spoon. It is recommended that subsurface soundings be used in connection with key test borings since a major complaint of a sounding operation by itself is that no samples are secured to determine the types of materials encountered. This difficulty can be overcome on very small subsurface projects by using a device such as the A-G penetrometer along with a sampling spoon. For jobs of this size, resistance data can be used to afford indications of the allowable bearing capacity. Of course, it is realized that a test of this kind can be satis-

factorily performed only to shallow depths. However, it is felt that this limitation should not pose a serious problem in obtaining preliminary information for small projects. The results of this type of investigation might be such that no additional studies are necessary; or, on the other hand, they might indicate the need for additional information.

A summary of the results of subsurface investigations, which included A-G penetration testing, on seven sites in the Syracuse, New York, area are included in this article. Standard penetration data were obtained on five of these sites. Unconfined compression tests were made on undisturbed samples from three of the four sites where cohesive materials were encountered. Finally, the results of the A-G tests are compared with those from the standard penetration and unconfined compression tests.

The soils investigated in this study represent seven construction sites in the Syracuse, New York area. The principal soils encountered at shallow depths in four of these sites were primarily cohesive in nature, ranging from low to high plasticity. Cohesionless materials, consisting primarily of sand, were encountered at the remaining three sites.

The physical characteristics of the soils investigated are as follows: A—red clay with some silt and trace of sand from Munnsville; B—red clay with some silt from Munnsville; C and D—gray-brown clay and silt from Syracuse; E—gray clay with some silt and trace of sand from New Woodstock; F—brown silty clay from Liverpool; G—fine to coarse brown-gray sand and gravel with trace of silt from Utica; H—fine to medium brown sand with trace of silt and gravel from Hancock airfield; and J—medium brown sand from Mattydale.

Testing Program

Standard penetration tests were performed on all except two of the soils investigated. These tests employed the common procedure of dropping a 140-lb. weight 30 inches onto the sampling spoon. A-G penetration data were obtained from each of the soils investigated. In the cohesive soils, the average depth of penetration with the A-G penetrometer amounted to 4 feet. The penetration in the cohesionless soils encountered at Hancock Field was 11 feet. In this case, the penetrometer was driven 3 feet, after which the hole was excavated and another 3 feet of penetration made.

This procedure was followed throughout the test to minimize the effect of skin friction on the penetrometer. When continuous driving is realized at depths greater than several feet, the effect of friction along the rod must be considered. At the Mattydale site, 6 feet of continuous driving with the A-G penetrometer was realized.

The laboratory tests consisted of classification tests and unconfined compression tests on the majority of the cohesive soils. The classification tests included specific gravity and natural water content determination, mechanical analysis, and the determination of the Atterberg Limits.

Unconfined compression tests were performed on samples obtained from all except one of the sites at the time the penetration tests were made. The cohesionless soils were classified on the basis of mechanical analyses performed on representative samples from each of the two sites.

The bearing values obtained from the A-G and standard penetration data are taken from curves and tables in Terzaghi & Peck. A-G values are based on $\frac{1}{2}$ N since the energy per unit area from this penetrometer when E-rod is used is approximately 50 percent of that realized in the standard penetration test. In the case of cohesive soils the agreement between the A-G and the standard penetration test is fairly good. A comparison between the A-G and the results from the unconfined compression tests indicated that in two of these three soils, the A-G results are on the conservative side.

Test results were as follows on the various soils with the estimated allowable bearing capacity by the A-G test, using $\frac{1}{2}$ N, first, followed by the estimated allowable bearing capacity as indicated by the standard penetration test: A—5,000 and 5,400; B—3,750 and 3,400; C—3,000 and 1,800; D—2,400 and 1,800; E—no comparison; F—3,400 and 2,100; G—3,500 and 4,000; and H—1,800 and 2,000.

Tests of the cohesive soils (C, E and F) showed that in all cases, the results obtained with the A-G penetrometer are higher than those from either the standard penetration or the unconfined compression tests. The reason for this discrepancy may be due to the fact that the effect of skin friction on the A-G penetrometer has been ignored. It is probable that the number of blows required to produce one foot of penetration should be reduced by

a certain factor when driving further than "several" feet. Although more data must be analyzed before a definite conclusion can be reached, excellent results are obtained from these three soils if $\frac{1}{3}$ N rather than $\frac{1}{2}$ N is used for estimating the allowable bearing capacity.

A comparison of the results from the A-G and the standard penetration tests, indicate that reasonably good results are obtained for the cohesionless soils (C and H). This would be expected since the standard penetration tests have been fairly reliable for obtaining bearing capacity indications for cohesionless soils, and the A-G test is but a modified form of the standard penetration test.

A general conclusion is that the A-G penetrometer is fairly reliable when used in cohesionless soils, especially when the effect of friction is allowed for, as in the case of soil series H. Additional data from cohesive soils is necessary before definite conclusions can be made.

This penetrometer should be useful for locating soft spots below footing grade and acquiring a basis for estimating their bearing capacity. After excavation of the site to footing grade, the A-G penetrometer can be used over the area of the footing to locate soft spots that may have been missed in boring operations performed prior to excavation. The A-G penetrometer should also prove valuable as a supplementary tool in making preliminary borings. It could be used for probing the site between bore holes and may point out soft spots close to the ground surface that might otherwise be missed.

References

- 1 "Soil Mechanics in Engineering Practice" by K. Terzaghi and R. B. Peck, J. Wiley & Sons, 1948 Art. 54.
- 2 "Bearing Value of Soils" by F. N. Kneas, Journal of the Franklin Institute, Vol. 223, No. 4, April 1937.

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Municipal Power Plant Buys 4630-hp. Engine

The municipal power plant of Brownfield, Texas, has purchased a two-cycle Nordberg Duafuel engine. The engine has 10 cylinders of 21½-in. bore and 31-in. stroke and its rating at the installed elevation of 3312 ft. will be 4630 bhp at 240 rpm. The General Electric AC generator will have a net rating of 3300 kw. This new engine, the third Nordberg to be installed since 1951, brings plant capacity to 13,580 hp, 9900 kw, an increase of 7500 kw.



DETAILED INVENTORY

AIDS

EFFECTIVE TRAFFIC SIGN PROGRAM

CHARLES IDEN,

Junior Civil Engineer,

Tulare County Road Commission,

Visalia, Calif.

A TRAFFIC sign administration program which enables county highway officials to maintain an effective traffic sign system has been established in Tulare County, Calif. This results from a comprehensive review and complete overhaul of the county's traffic sign system which came about in 1953. One of the first steps in that program was to inventory every sign in place on the county roads; reevaluate their performance, location and condition; and correct any deficiency which made a sign less valuable as a communication device.

There are 3,125 miles of roads in Tulare; 350 miles in mountainous terrain, 400 miles in and about urban areas. There are more than 12,000 traffic signs guiding, warning and regulating traffic on the county road network. It took 18 months to complete the inventory, with two men devoting about 90 percent of their time, and a supervisor devoting 50 percent of his time to the job.

The reason it was worthwhile was that highway officials realized from the inventory that the county's traffic sign system was inadequate—even obsolete in some cases. Such factors as the size of the sign, its location, its placement and its visibility, were some of the things which made many of the signs less efficient or completely useless.

The inventory revealed that some signs in place 15 or 20 years were sized for 40 mph traffic, yet the roads had been improved to 60 mph status, so the signs were not efficient nor effective. Some of the signs, though still in good condition, were installed before night driving became as common as it is today and they were not designed for good



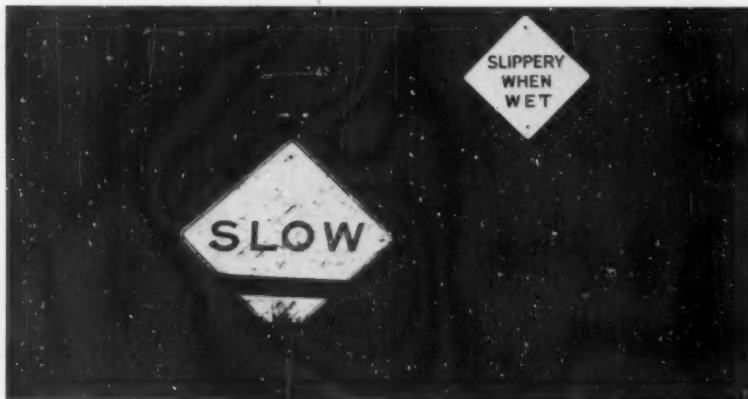
● TRAFFIC signing, responsibility for which was previously spread among five men, is now handled by Mr. Iden. At right is Joe Garcia, County Road Commissioner.



● DATA SHEETS give information on all of the 12,000 signs in the County. Tell-all codes in the four boxes give pertinent data on each sign, including name of manufacturer, date of last maintenance and type of maintenance. All sheets relating to signs on a specific road are kept in a single file folder, permitting quick reference.



● "SLOW" SIGN shown above was marred and no longer suitable for regular use so it was employed as construction zone warning. "SLIPPERY" sign meets new standards.



● NIGHT DUTY is easy for these reflectorized signs. Use of the out-of-condition "SLOW" sign is an example of how Tulare County gets the most value from its signs.

nighttime visibility. Others, though reflective, were not visible enough at night to be effective for motorists traveling at today's speeds.

Making the Inventory

To simplify the inventory, and permit a study of the traffic sign system in localities and as a whole, a form blank was prepared to record the data needed to make an accurate appraisal of each sign. The form was prepared in such a way that the records could remain up-to-date continually.

The form is a single sheet of 8½ by 11 white paper for easy handling in the field. In the upper left corner is a simple code key which uses a letter to designate the most recent attention given the sign in the field (A for install, B for replace, C for repair, and so on); a number designates the manufacturer of the sign.

Four boxes on the sheet, with three columns and five horizontal lines in each box, are for recording information about the sign. The entries show the type of sign, the attention last given and the date of entry. A diagram of an intersection in the middle of the form permits mapping the exact location of the sign.

When the inventory was completed, Tulare County files had the exact location and description of every traffic sign in the county. There were not 12,000 forms, for several signs can be mapped on a single form if they are at or near one location.

When a new sign is installed, a new form is made up. When repair, maintenance or other attention is given to an existing sign installation, a similar form on yellow paper is submitted by the sign crew and the information transmitted to the master sheet at the road commission office. Then the yellow form is destroyed. The date of installation or replacement is stenciled on the back of each sign.

Traffic sign administration goes further than record keeping, however. For example, when a new sign is installed, even with the best known procedure in traffic signing, we make a double check of the sign under traffic conditions. We approach it at varying speeds to determine its visibility, checking the time it allows for driver reaction. This is done both day and night, because we have come to realize that day and night are two completely different driving situations.

Too many times we have found that a sign placement or location which is effective during the day will have to be relocated to make it equally effective at night.

All of our reflective signs are surfaced with wide-angle reflective sheeting to make them brightly visible at night in color, shape and message.

During the year, the supervisor of the traffic signing system—who spends about 50 percent of his time on traffic signing—schedules his trips into the fields in a pattern so that at least twice each year the entire sign system is inspected. He also covers the sign system at least once each year at night.

A three-man sign crew is in the field almost constantly. Two men maintain existing signs by repairing and replacing damaged signs, painting posts, removing weeds and other general maintenance work. The third man makes new installations as required.

One remarkable finding has resulted from keeping our signs in good condition and keeping their appearance up: Vandalism has decreased considerably. Apparently the vandal is more respectful toward a traffic sign with a neat appearance; or perhaps a sign which obviously receives consideration conveys its importance to the would-be vandal.

Sign Maintenance

Sign maintenance is done at the county sign shop. The county owns a heat-vacuum applicator with which we can apply prepared reflective sign faces to salvable metal blanks. The process involves removing the old sign face, peeling a protective paper backing from the new reflective sign face, laying it on the old metal backing, and putting the sign in the applicator where heat activates the adhesive on the back of the sign face. The adhesive bonds the new sign face to the old sign backing.

The cost of maintaining this up-to-date sign program is about \$20,000 per year including payrolls, equipment rental, new signs, sign materials for refinishing old signs and all other costs.

The investment is worth it. Tulare County officials, including road commission, enforcement and safety authorities, all agree that the result has been a smoother flow of traffic on all county roads. Though we have no statistics available on which to base it, we feel there has been a resultant decline in the ratio of accidents per vehicle miles.

CALCULATORS

SAVE



TIME

FOR COUNTY HIGHWAY DEPARTMENT

JAMES F. MEISNER,

Marion County Engineer,

Marion, Kansas

CALCULATING machines have been used in the Marion County, Kansas, highway offices for the last decade, but to tell about their use is like telling how we use our muscles when we breathe. The machines are very much a part of our daily operations.

Our county is a "county unit" county, which means that we take care of the construction and maintenance of all the roads, culverts, and bridges on our 1624-mile sys-

tem. It is easy to see that with this small administrative force we must depend upon machines to speed up our record and cost accounting work.

Our office is equipped with two Marchant calculators, one adding machine and one reproducing or printing machine. We do not have a drafting machine on our design board as we utilize, as much as possible the standard plan sheets of the State Highway Department in our bridge work. Such a machine would help us in our adaptation of the standard plans and we hope to install a drafting machine soon.

Other machines that help us handle the administrative work are our

fifteen years ago when the County Clerk found that his trade-in allowance on a new machine was negligible, and I was able to get the old one transferred to the Engineer's office rather than having it traded in on the new machine.

We took the trouble to have the salesman spend some time with us to instruct us in the proper use of the old machine. We found it was more than just a machine to add, subtract, multiply and divide. It was a machine that simplified and speeded up all our record work and computations.

This old discarded machine soon proved our need for a good calculator in the office that probably does



● "OUR office probably does more actual calculation than all other offices within the Court House," says the author.

tem of local roads. Inventory on these roads shows that to date, we have 106 miles of double asphaltic seal, 848 miles of light type surfacing, and 670 miles of graded non-surfaced roads.

In general, this work is accomplished by an average force of 60 employees. To co-ordinate and record their work and costs, we have two registered professional engineers, a road superintendent and two office clerks.

four portable short wave radios and central station, and our air conditioning unit in the office. The first allows us to have immediate coverage of the county from the office; the other increases the efficiency of the office workers, not only improving their spirit, but eliminating the sweating and stickiness in handling papers and drawings.

The calculators are really our right arm in our cost accounting work. We started using them ten or

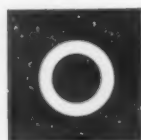


● IN ROAD design work, calculators save laborious arithmetical computations that are fraught with danger of errors.

more actual calculation than all the other offices within the Court House. True, the County Clerk occasionally will borrow one of our machines to supplement his machines in tax computation time, but this is only seasonal and our demands are daily.

Within a short period the County Commissioners recognized the value of the calculator and authorized replacement of the old machine. A

(Continued on page 126)



OPERATION OF LOUISVILLE'S NEW INCINERATOR

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Chief Engineer,
International Incinerators, Inc.
Atlanta, Georgia

THE EVER increasing population of Louisville, Kentucky, made it mandatory to turn to a modern method of refuse disposal instead of continuing use of inadequate, nuisance-creating city dumps. Many persons, including Mayor Andrew Broaddus and John W. Leake, Director of Sanitation, contributed to the solution of Louisville's disposal problems. It was decided to adopt an incineration process that would dispose of mixed refuse, heavy timbers with nails and trees up to 30-in. diameter; and to incorporate facilities for drying sewage sludge. In addition, every effort was made to design a plant that would produce revenue from the sale of by-products.

Collection of garbage and other refuse will be combined, since the Louisville incinerator is designed to handle mixed refuse. This is dumped from the collection trucks into the storage pit, as indicated by point (A) on the diagram herewith. Waste building materials are received at the plant at point (B). The problem of handling materials containing nails was solved by the installation of a no-knife wood hog manufactured by the Williams Patent Crusher and Pulverizer Co. This will reduce any lumber up to 6 x 12 ins. in size to small, easily burned chips, nails notwithstanding. As Louisville frequently is confronted with disposal of trees up to 30-in. diameter, a knife type wood hog manufactured by the Diamond Iron Works was installed at point (C). Both of these units discharge to a chip conveyor (D) which transfers wood chips to the storage pit.

Two five-ton air conditioned Harnischfeger cranes (E) keep the incinerator units charged with a

uniform mixture of refuse. The more uniform the refuse, the easier it is for the operators to maintain even temperatures in the incinerator units resulting in better performance and reduced maintenance. Thus the crane operator has much responsibility for the proper operation of the plant and it is essential for him to know the temperatures in the incinerator units at all times. Signal lights located above each incinerator hopper are flashed by the panel board operators to indicate when excessive temperatures are being encountered.

At certain times during the year dry, highly combustible refuse is received in the refuse storage pit. To prevent excessive temperatures in the furnaces, provision is made to wet the mixed refuse in the storage pit by use of water sprays. A zoned water spray system controlled by the crane operator blankets the pit area. When no wet refuse is available, the crane operator may use the water sprays to provide an easy means of temperature control; and these can also be used for dust control when required.

Incinerator Units

The building and all equipment is constructed for four incinerator units of 250 tons capacity per 24 hours. Three units are presently being installed as shown at point (F). These provide continuous feed, continuous advance and tumbling of refuse with continuous discharge of residue. Each unit uses reciprocating type drying and ignition grates, a rotary kiln and a combustion chamber. A by-pass around the rotary kiln is provided.

The feed chute is approximately 4 1/2 ft. wide by 7 1/2 ft. long and is refractory lined. A refractory lined hopper plug is placed over the feed hopper when the units are to be removed from service.

The drying chamber utilizes part of the heat from the burning opera-

tion in the ignition chamber to remove moisture from incoming refuse. This permits burning refuse which has a net calorific value as low as 2300 Btu per pound without the use of auxiliary fuel. To accomplish this, part of the heat from the ignition chamber is diverted over the refuse in the drying chamber. The resulting moisture laden gases by-pass the rotary kiln to the combustion chamber. Siftings from the drying grates are conveyed by cast steel screw conveyors to the ignition grates for burning.

The actual burning cycle is started in the ignition chamber and normally 50 percent of the burning cycle is accomplished there. Both the drying grates and ignition chamber grates are of the reciprocating type. Combustion air is supplied to special side wall castings on each side of the refuse bed and then through the ignition grates. The purpose of these air cooled castings is to minimize clinker formation at this point and to provide suitable renewable wear surfaces. A motor-driven damper adjusts the inlet vane on the Sturtevant forced draft fans for controlling the correct amount of combustion air. Overfire air, when required, is supplied to the combustion chamber and entrance of the rotary kiln by means of a Buffalo Forge fan through stainless steel nozzles.

Siftings from the ignition grates are conveyed to either of the twin residue conveyors by cast steel screw conveyors.

The rotary kiln enables the complete destruction of the mixed refuse without manual stoking as constant agitation is accomplished by the rotation of the kiln. The kiln is followed by a combustion chamber which reheats the by-passed gases from the drying chamber to 1300°F or more for odor control.

Controls for each incinerator unit are grouped on a control panel which combines smoke indicator,

draft gauges, pyrometers and recording instruments and variable speed controls for the drying and ignition grates and the rotary kiln. The panels were made by the Louis Allis Co., which also furnished the Ajusto-Spede motors that drive the grates and kiln. The control panels are so arranged that one man can operate two units. All the variable speed motor control equipment, starters and disconnect switches are grouped inside each respective panel to permit easy servicing.

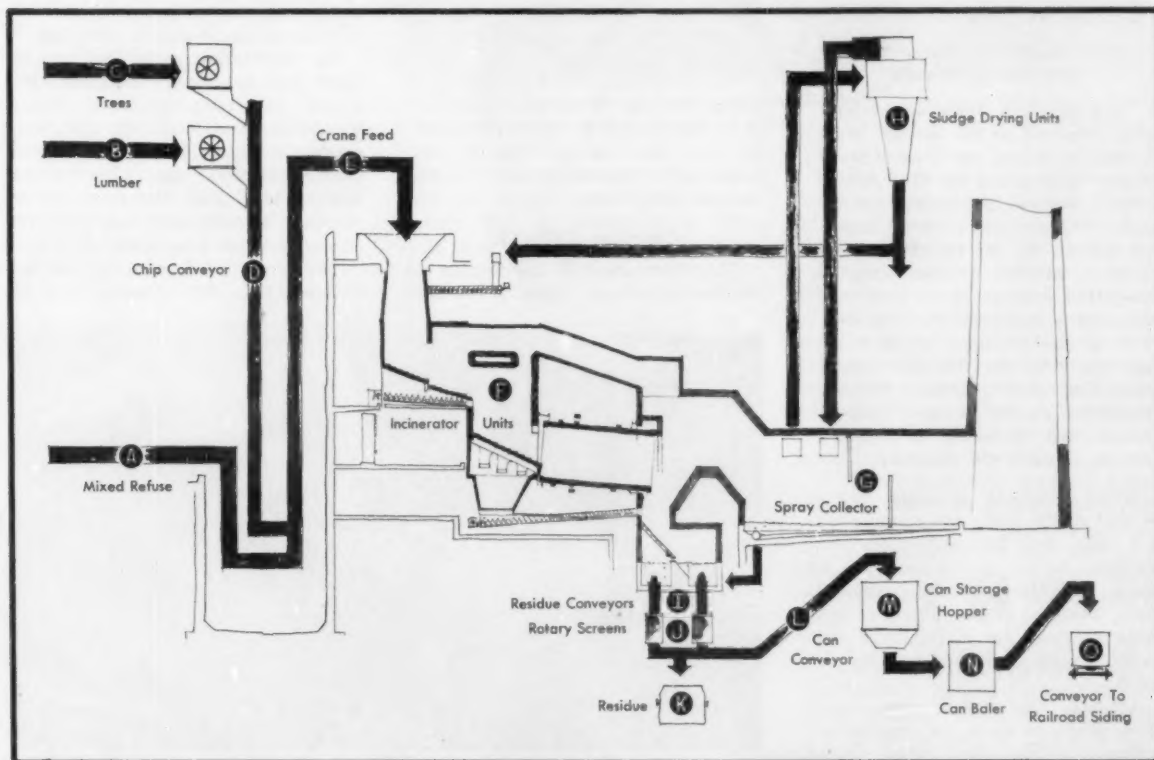
Gases from the combustion chamber are pulled through the spray collectors, shown at (G), by

Drying Sewage Sludge

Flash drying equipment furnished by Combustion Engineering Co. is installed at the plant for drying sewage sludge. This unit receives hot combustion gases to dry the sludge and returns the moisture laden gases to the spray collector ahead of the water sprays. When the City's new sewage treatment plant is completed, sludge from the vacuum filters will be placed in totally enclosed semi-trailers and transported to the incinerator. The dry sludge will be sold as a fertilizer filler or as a fertilizer. Any excess

can processing equipment without shutting down the plant proper.

After tin cans and scrap are separated, the residue (K) is a fine black ash not larger than 1-in. dia. Dempster-Dumpster 6-yd. drop bottom containers are used to receive the residue from the rotary screen. The containers will be filled on a 24-hr. basis and stored on an adjacent area. This arrangement requires the minimum number of trucks and permits trucking of the residue during the day shift. The residue is completely burned and is in demand for fill and various other uses.



● SCHEMATIC flow diagram shows the passage of materials through the incinerator. Letters refer to the text description.

means of the natural draft from the 200-ft. high Custodis chimneys. Baffles constructed of 1/4" plates are entirely flooded at all times by flat spray nozzles. There are two sets of baffles in each spray collector arranged to collect the fly ash by impact on the wet surface of the baffles. The wet fly ash is washed down the faces of the baffles into the wet bottom of the spray collector. Other spray nozzles in the bottom of each collector agitate the fly ash and assist in the draining operation. At regular intervals the wet bottom is drained into either one of the residue troughs where excess water is drained off by an overflow.

may be discharged by means of a pneumatic conveyor to either of two incinerator units for burning.

Twin drag chain type residue conveyors (I), water filled, are provided at the plant. A gate diverts the residue into either of the conveyors since only one will be used at a time, the other being a spare. The residue conveyors were furnished by Beaumont Birch Co.

Rotary screens having 1 1/4-inch holes (J) are used to separate the residue from the cans and scrap iron. The conveyor discharge head assemblies are so arranged that the residue may be discharged directly into the rotary screens or by-passed to facilitate maintenance of the

An inclined drag chain type conveyor is used to transport cans from the screen discharge to the can storage hoppers (L). Water sprays placed about half way up the conveyor wash the cans as they travel up to the sprays. The can conveyor was furnished by the Beaumont Birch Company.

A concrete can storage hopper (M) with 24-hr. capacity is provided. The bottom of the hopper is constructed of steel plate and four gates permit removal of the cans. Vibrators adjacent to each gate are provided to prevent jamming. The vibrators will be operated only when required.

(Continued on page 176)

DUST CONTROL

BY THE USE OF SALT, CALCIUM CHLORIDE AND BITUMINOUS MATERIALS

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Civil Engineering Department,
University of Illinois

This article is based on information presented at the session "Dust Control on Gravel and Crushed Stone Roads" held during the 43rd Annual Illinois Highway Engineering Conference. The program included recommendations for the effective use of calcium chloride, sodium chloride (hereafter referred to as salt) and bituminous materials for dust control by representatives of these respective industries. The participants were Harry Smith, Calcium Chloride Institute; James Duncan, International Salt Company; and Mark Brown, Standard Oil Company.

LOCAL ROAD officials realize that dusty roads are a real problem. The dust that settles on clean washing, furniture and crops brings many complaints from residents along unpaved roads. There is constant pressure for higher type surfacing where it is not justified by traffic.

Actually the dust is even more of a problem than the complaints indicate. This dust that blows away is the binder that holds gravel and crushed stone roads together. Its loss results in raveling or loosening of the aggregate surface. The aggregate is then piled up in hazardous windrows by the abrasive action of traffic or thrown into the ditches. Time consuming maintenance operations are required to get what can be salvaged and once again tie it down on the road surface. Approximately \$200 million is spent annually for aggregate replacement alone on about one million miles of secondary and local roads.

Dusty roads are also a driving hazard. In 1954 the State of Iowa attributed 49 traffic fatalities and 1376 injuries to loose dusty roads. Loose aggregate occurring through

the loss of fines causes property damage as broken head lamps and windshields.

The following recommendations cover the use of various materials in a dust control program. Naturally they must be modified to suit local soil, climatic, traffic and aggregate conditions.

Calcium Chloride

There are several approaches to the use of calcium chloride for dust

but results in the loss of a portion of the aggregate due to raveling.

As traffic increases or treated spots become closer together, full length calcium chloride treatment should be considered. By following proper recommendations, a smooth riding dustless aggregate surface can be developed. The maintenance items of blading and aggregate replacement can be reduced.

The successful use of calcium chloride in a dust control program



● DUSTY road is reminiscent of days of long ago. Blinding cloud can be unsafe for motorists. Note loose aggregate along shoulder, another hazard for the driver.

control. The first step in many areas is spot treatment. This is a simple operation involving the uniform spreading of calcium chloride for 200 to 400 ft. in front of schools, churches, residences and such danger spots as bridges, intersections and railroad crossings.

Another method of using calcium chloride is the treatment of replacement aggregate that is used to strengthen or patch potholes and weak spots. Calcium chloride retains moisture so the new material can be compacted by traffic. If moisture is not retained, the material usually becomes loose and dusty. This is not only a hazard

depends on three things: 1. Proper conditioning of the road; 2. uniform application of calcium chloride; and 3. correct maintenance procedures

Conditioning a road for either spot or full length treatment should begin during the winter or early spring when the surface contains moisture. The aggregate thickness layer should be from two to six inches, depending on soil, climate and traffic. This should be well graded material that will compact readily. Shaping the crown to proper cross section is very important in reducing the occurrence of potholes. An "A" type crown of

½-in. per foot works best. After shaping it is important that the material be compacted, either by traffic or rollers, while moist.

After surface is compacted, calcium chloride is uniformly spread at the rate of 1.0 lb. (type 1) or 0.8 lb. (type 2) per square yard. Heavier treatments are beneficial for patching and for spots that will not receive subsequent summer applications. Calcium chloride may be spread in dry form or converted to a solution before application. Equipment used depends on availability and includes material spreaders used for winter maintenance, chip spreaders, grain drills and, for a solution, pressure distributors piped for recirculation.

The calcium chloride road requires far less blading during the summer than an untreated road. Blade only when necessary and then when the surface is moist. During long dry spells, any loose material that develops should be bladed lightly to the side. It is important to raise the blade when passing over a calcium chloride treated area on a spot treated road. The only other



● STABILIZED bases provide good support for light bituminous treatments. Here a bituminous prime coat is placed on a salt stabilized base. Seal coat will follow.

viding better particle lubrication with less moisture and it increases density by recrystallizing in the voids. For this reason there is less loose material to cause dust.

Before a road can be stabilized

Usually a rotary blade mixer, disk harrow or grader is used. In order to assure thorough mixing, this operation is often performed in a mixing plant of the pugmill type. About one gallon of water per 2½ pounds of salt is necessary to dissolve the salt completely. After mixing, the material is spread to proper cross section and compacted by traffic or rubber-tired rollers. Adequate crown of the "A" type should be provided for surface runoff.

A 6-in. stabilized surface runs between \$500 and \$600 per mile for salt, labor and equipment rental on an 18-ft. road in the midwest. Salt costs about \$8.40 per ton at the mine, in bulk and increases in proportion to the distance it is shipped.

Some Illinois Counties have used oil well brine with great success. The brine is hauled in 1000-gallon tanks directly from the well and applied at the rate of 20,000 to 30,000 gallons per mile. This brine is a 7 to 10 percent solution. The production of brine specifically for such use is usually uneconomical and is not recommended by industry representatives.

Due to the added compaction and recrystallization attained with the use of salt, the road surface cannot be maintained except during a rain. It is too hard to be bladed between rains. In maintaining a salt stabilized surface do not cut out irregularities with the grader blade. Grade by not cutting more than ¼ in. to ½ in. deep. This light roll of material in front of the blade will fill any deep irregularities with an already treated material which compacts readily in its rain moistened condition. Proper maintenance



● COMPARE this gravel road with the one on the facing page. This surface was treated with calcium chloride, reducing aggregate loss and costs of maintenance.

summer maintenance is one or two subsequent applications of calcium chloride at the rate of 0.5 lb. (type 1) or 0.4 lb. (type 2) per square yard as dusting starts but before the surface dries to the point of raveling. The cost of full control treatment on an 18-ft. surface is about \$500 per mile per year. Spot treatments over 100 ft. in length would be in proportion to this.

Salt

In the first place salt is not a dust palliative. It is not deliquescent so it is not effective as a surface treatment. Salt is used to aid the compaction of granular material by pro-

with salt, there must be a minimum of three inches of surfacing material on the road. Material with about 10 percent passing the No. 200 sieve usually works well. If this material is not loose, it should be scarified.

After the aggregate surfacing has been loosened, the salt is spread. The rate will depend on local experience but ½ to ¾ pound per square yard per inch of depth is used in several areas. Salt can be spread with the same type of equipment recommended for spreading dry form calcium chloride. Water must then be added and the material thoroughly mixed as agitation is necessary to dissolve the salt.



● PUG MILL for mixing salt, water and aggregate is shown suspended over truck.

can be accomplished during dry weather if the added cost of heavy sprinkling is justified.

The presence of salt in the surfacing material does retard the evaporation of moisture. If the surface dries and begins to ravel, surface applications of calcium chloride as a dust palliative will retain surface moisture. As traffic increases above the range of 100 to 300 vehicles per day and the surface becomes difficult to maintain as an unpaved road, a bituminous wearing surface can be added.

Bituminous Materials

Some light bituminous materials known as road oils are sprayed on unpaved roads for dust control. Due to many poor experiences, this is not looked upon with approval by some people in the bituminous industry. The base is usually of inadequate thickness and not properly compacted. Maintenance problems increase as potholes develop. Unfortunately the public considers any black surface as a "blacktop" road. To them an unsatisfactory oiled road is just a poor "blacktop."

The use of a prime and seal coat over adequate base is the best approach for satisfactory use of bituminous materials for dust control. This not only eliminates the dust problem but provides a higher type surface. It also protects the base from the effects of weather and traffic.

As traffic increases, additional seal costs build up a substantial surface thickness. Eventually a bituminous mat surface should be placed thus completing the transformation to a higher type road through stage construction.

The construction and maintenance of bituminous surface treatments is a subject in itself and is too lengthy to be included here. The main point

to remember is that the base must be of adequate thickness for the conditions and it must be evenly compacted. Many highway agencies require a minimum base thickness of around 6 or 7 inches before approval of expenditures for such treatments. Another important point to consider is the amount and plasticity of the binder soil in the base aggregate. Sealing off the evaporation of moisture brought up to the top of the old aggregate surface by capillarity will cause instability of the base and ultimate failure if the amount and plasticity of the No. 200 sieve size material are high. The cost of a prime and seal coat in the Midwest averages about \$2,000 per mile for a 22-ft. width.

Other materials used on unpaved roads for dust control in limited areas are paper mill waste and abandoned oil well brine. Materials such as these are inexpensive and in some cases free, but they are used in very limited areas due to lack of uniformity and the large quantities necessary to produce satisfactory results.

Mechanical Stabilization

Perhaps some mention should also be made of the fundamental requirements of a stable, easily maintained soil-aggregate surface. Much research is under way as a result of our general lack of knowledge concerning the multitude of variables affecting gravel and crushed stone road performance, but the literature is full of information taken from past experience. This allows us to set up general criteria for recommended practice. No hard and fast rules are justified because there are so many variables in aggregate and soil, such as gradation, particle shape, soundness, cohesion, surface texture and grain size which either have not been fully evaluated or

have not been investigated thoroughly enough to determine the magnitude of their relative effects.

In spite of these uncertainties there are some fairly well defined limits of soil composition design within which a good soil-aggregate surface can usually be assured and outside of which failure can be expected. Foremost among these are the limits on the amount and plasticity index of the binder soil and aggregate strength and gradation.

Space does not permit a detailed discussion along this line, but unless attention is given to these requirements the problem of control of dust and loose material is not so readily solved. It is usually impossible and always uneconomical to overcome the inherent instability of an improperly designed soil-aggregate mixture by surface treatment.

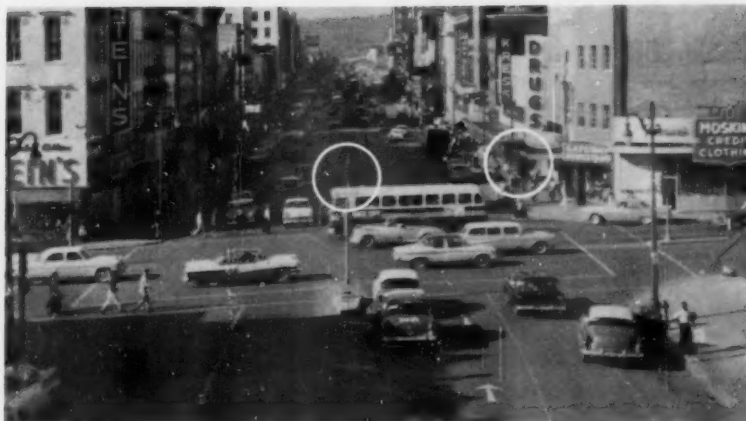


● SALT is being applied to scarified road surface, Logan County, Ill.

Cleveland Must Cease Burning on Dumps

The Cuyahoga Co. Court of Appeals has refused Cleveland additional time to construct a proposed incinerator. A taxpayer's suit was filed demanding that the burning of combustible materials on the lakefront dump be halted on the grounds that such burning constituted a public nuisance. The Court of Appeals decision reinstated a previous order of the Common Pleas Court. All dump burning was ordered ended by January 1. The fact that dump burning has gone on for 50 years, the Court said, "has no significance in view of the overwhelming evidence that such method of disposing of combustible wastes is archaic, outmoded and unnecessary." In determining that it was a public nuisance, the Court termed dump burning "as outmoded and old fashioned as the use of a horse and buggy."

● FIRST intersection on Market St. has signals on island in center and at far right; other intersections have a span wire suspended signal. Approximately 15 seconds after this picture was taken, all cross traffic had cleared the intersection and North-South traffic was moving. The traffic control system was furnished by Automatic Signal Division.



CHATTANOOGA'S ELECTRONIC TRAFFIC CONTROL SYSTEM

MARBLE J. HENSLEY,

Traffic Engineer,
Chattanooga, Tenn.

○ RIGINALLY, Chattanooga's downtown signal system of 30 intersections was controlled by a single dial controller operating on a double alternating progression. This system operated on a 60-second cycle and it often required 10 to 15 minutes to travel ten blocks through the downtown area. It was necessary for the signals to be turned off and police officers to direct traffic manually at several intersections during the afternoon peak.

Since our traffic volume fluctuated considerably during the entire day, we felt that we must have a system that would respond to the fluctuations. We have a heavy volume of traffic to and from the downtown

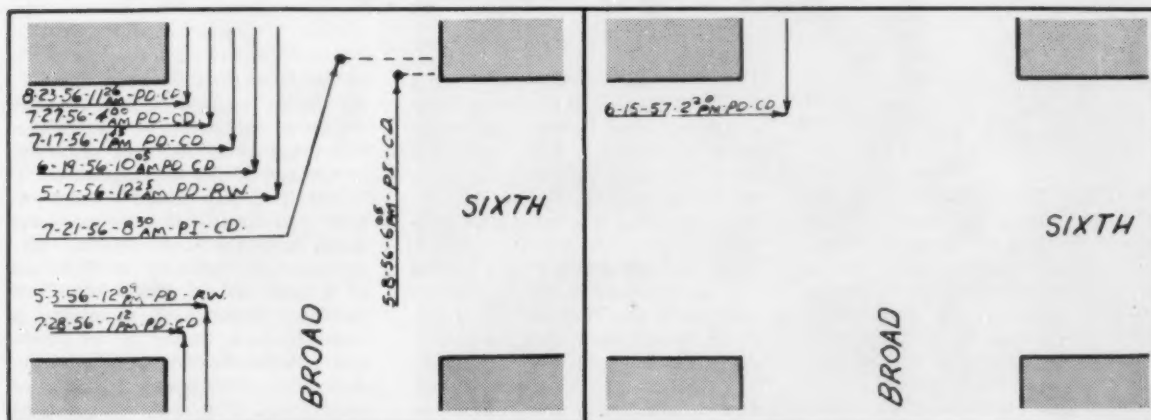
area during all hours of the day, with large volumes of through traffic. We also had very heavy north and south traffic flows because of no by-pass around the city. By the same token, our east-west movements have been increasing very rapidly. These streets lead into some of our newest suburban areas which are growing very rapidly. With our future freeway being located to the west of our downtown area and with two main off-and-on ramps at Fourth and Ninth Streets, we felt that it would be practical to install an electronic traffic signal system.

One of the most important factors in this electronic signal control system is the location of the counting stations. These sampling detectors must be so located that they will always give a true indication of traffic flows within the signal system.

We made extensive traffic counts

before locating these counting stations and are now using eight stations—four inbound and four outbound. Whenever the new on-off ramps are completed for the freeway we believe it will then be necessary to have additional counting stations and a second panel to our electronic Master to obtain additional east-west movements.

Another real advantage of this system is that the individual intersections seek their offset position by the shortest possible route (forward or backward). This prevents long delays and false progressions. This system also takes 3 cycle lengths to obtain the new offset position; in other words, 1/3 in each of three cycle lengths. With this arrangement, we never find the system operating in jerky motions or its intersections being stopped because of long red periods while the con-



● ACCIDENT record at an intersection is shown by plots for similar periods in 1956 and 1957. "After" record at right.



● SECONDARY controllers are located at each intersection in the controlled area. Traffic Engineer Marble Hensley, the author, makes an adjustment on one of these.

trollers seek their offset. This smoothness of operation is obtained through the controllers seeking the new offset position by the shortest possible route and using three cycle lengths to obtain the new setting.

In developing our time span charts we were able to obtain a very good progression. This progression is at speeds of 20 to 30 mph and works for both north-south and east-west movements.

Our Master Control equipment is located in the basement of the City Hall and new secondary controllers are located at each intersection.

During the remodeling of this system, it was necessary to re-work completely the entire installation; and we have also standardized signal head locations and have installed a center-suspended signal and a far-right signal head, thus giving double indications on all the downtown streets. We have, in addition, installed separate walk-wait signal indications for the pedestrians. We have provided additional circuits for the counting station.

We have a very fine progression for both north-south and east-west traffic flow. We have used advance

greens at several intersections in order to allow for left turns. At present, the north-south movements range from 20 to 30 mph and the east-west range from 18 to 32 mph. We are operating the system with cycle lengths from 55 to 80 seconds. We are using an average, inbound, outbound and simultaneous progression. With all of these progressions we are obtaining actual operating speeds of from 18 to 32 mph. Because of the layout of our downtown area, we favor certain directions on some streets for both inbound and outbound movements. We have been amazed to find that this new signal system, operating on actual traffic flow, will go to outbound progression during the morning rush, and possibly again two or three times during the middle part of the day; we even find that this system will go to inbound progression as late as 4:30 in the afternoon. The reverse has occurred for the outbound progression. We have this system set so that it is capable of changing offsets at the rate of every two minutes and the dials are set so they can increase cycle lengths every minute and decrease cycle length every four minutes. All of these periods are adjustable.

Since this new electronic system has been in operation, we have not had to turn off any intersections and are actually transferring policemen for work at other locations. We believe that this system can be expanded to handle the entire signal system of Chattanooga through this one controller.

CONSERVATIVE NEW ENGLAND CITY GOES ON THE AIR

JOHN F. DANIELS,
Commissioner of Public Works,
Pittsfield, Mass.

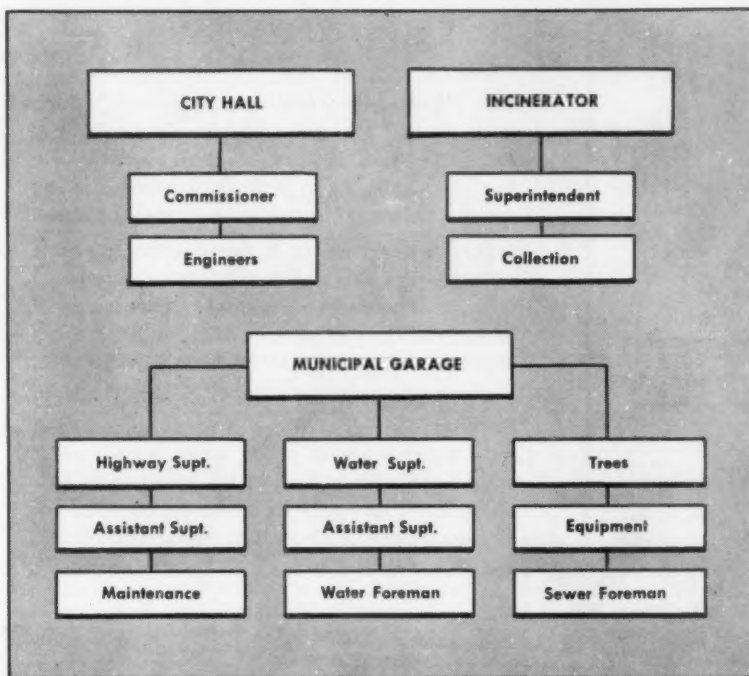
UNDER THE DIRECTION of Commissioner of Public Works John F. Daniels, the Department of Public Works of Pittsfield, Mass., has had in operation, since 1954, a two-way radio system. Authorization was granted by the Department of Commerce for this station to use 37.94 mc. for highway maintenance and operation. The base station located at the Municipal Garage about a mile from the City

Hall, was assigned the call letters KCD-502. At this base station there is one full-time licensed radio operator on a 40-hr. week basis, but it is manned around-the-clock, garage attendants taking all messages on nights, weekends, and holidays.

The Department of Public Works has approximately 200 employees included in the Highway, Forestry, Water, Sewer, Sanitation, Engineering, Administration and Municipal Garage divisions. There are two remote control units, one in the Engineering Division of the office of the Commissioner, and the other

in the Sanitation Division, the latter being utilized mainly in the collection of garbage and refuse. There are 14 mobile units plus one in the car of the Commissioner.

The two-way radio equipment was purchased under matching funds with the Civil Defense Department of the City of Pittsfield at a total cost of \$6987. The Civil Defense Department maintains a separate base station at its headquarters which can operate jointly with this department in case of emergency. The maintenance cost of these units is \$99 per month under contract with Motorola Com-



● BASE station at municipal garage and two remote control units serve Pittsfield.

munications and Electronics Inc., on a 24-hour service basis. The service thus far has proven very satisfactory with a local Motorola representative handling this maintenance.

The base station at the Municipal Garage is the "hub" of all radio activity. This station is in a favorable location for sending and receiving, being relatively free from outside interference. The radio room, glass enclosed, approximately 6 ft. x 10 ft., houses a 60-watt Motorola control equipment with meter panel which includes transmitter and receiver, with the antenna being mounted on the roof of the garage building. The radio operator logs all messages, incoming and outgoing, between the mobile units and the remote control units, and relays messages pertinent to each division. He is familiar with the location of all daily operations and informs the Police and Fire Departments of temporarily closed streets due to construction, whether from street, sewer, water, or forestry operations. The transmitting station has a range which reaches all over the city, the area of which is 42 square miles; and to surrounding towns for a distance of 12 miles.

2-Way Mobile Units

All mobile units are 30-watt and are in the following vehicles: No. 1 sedan of the Commissioner; pick-up trucks of the foremen of

Highway, Water and Sanitation; "patch" truck of Highway Division; maintenance trucks of Sewer, Water and Garage; and truck of Forestry Division. During the winter the radio units in the Forestry and "patch" truck are transferred to heavy-duty trucks on sanding, salting and snow removal operations. The radio in the Commissioner's car enables him at all times to be in direct contact and control of all de-

partmental activities, as well as with his office in the City Hall. This is a most important function of radio equipment in a city the size of Pittsfield, (population 55,000) where many times during the day there are decisions affecting daily operations to be made. Actually, the department has in the field approximately 100 vehicles of all types and contact is maintained with all.

The remote control at the City Hall provides contact with the Commissioner, even when out of the office. The engineering division can be reached to furnish lines, grades and other information at a moment's notice. The remote control unit at the Incinerator of the Sanitation Division facilitates the operation there in that complaints on garbage collection can be checked into at once and followed through on radios in foremen's vehicles. The department has 7 packer-type trucks on collection of garbage and refuse operating on a daily schedule and contact with them is maintained at all times.

The Water Division is a vital function of this department, not only in maintenance and construction of water mains, but also in watching over the gravity flow from our watershed of approximately 4200 acres. The Superintendent and two foremen keep a constant check on all operations, and equipment can be transferred quickly from one job to another when the occasion arises.

Highway maintenance work covers a multitude of duties and the
(Continued on page 177)



● RADIO OPERATOR at the municipal garage relays messages to each division, thus keeping the Commissioner and others in direct contact with all departmental work.

20% More Hopper Capacity! Start Reloading in 4 Seconds!

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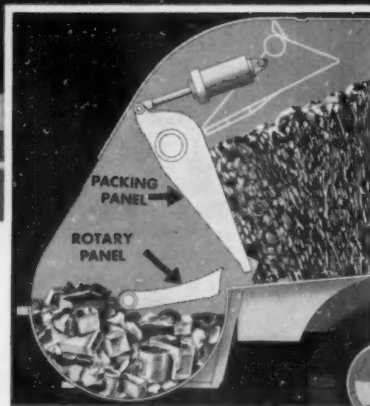
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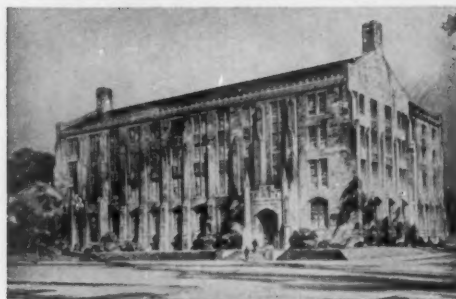
NEW CYCLOMATIC PACKING combines speed with simplicity of operation. Hopper is cleared for reloading in 4 seconds. Full-width packing panel exerts up to 81,000 pounds of force to give you 25% greater loads.



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LOCAL CHAPTERS REPORT ON MEETINGS

Iowa Chapter Meeting Features Boat Ride On the Mississippi

Dubuque, Iowa—Over 100 members and guests attended the Ninth Annual Meeting of the Iowa Chapter. Street Commissioner C. E. Allen did an outstanding job as General Chairman of the Local Arrangements Committee. Ken Cullen, City Engineer of Dubuque and President of the Chapter, presided at the opening session, which included Invocation by Dr. Gaylord M. Couchman, President of the University of Dubuque and an address of welcome by Mayor Charles E. Dove.

One of the high spots of the meeting was a boat excursion on the Mississippi River with a reception and buffet dinner sponsored by the equipment and material members of the Chapter. The ladies in attendance enjoyed a special program which was arranged by Mrs. Geraldine L. Jenni, Secretary to the City Manager.

The technical portion of the program included a talk on "Insect and Rodent Control" by Carl Smith, Assistant Health Director of Cedar Rapids, and another on "The Relation of the Municipality to the Contractor" by Clyde Elrod, Engineer of the Schueller Construction Company of Dubuque.

Other topics covered were: "Automation Traffic Control by Synchronization" by H. B. Allen of Des Moines and "Maintenance Contracts" by Robert M. Tutton, District Engineer, Iowa State Highway Commission. The program also fea-

tured an excellent panel discussion on "Sound Municipal Practices vs Public Sentiment". The panel included Mayor L. L. Grimes of Marshalltown, Mayor J. P. Lawlor of Ames, Robert L. Price, City Manager of Ottumwa, and Ralph Graham, Superintendent of Public Construction of Davenport. Another important topic, "Municipal Govern-



● IOWA Chapter—President-Elect Anderson (left) receives the gavel from Retiring Chapter President Ken Cullen.

ment and the Press" was ably discussed by Harry Boyd of the Cedar Rapids Gazette and Al Link of the Dubuque Telegraph-Herald.

The closing luncheon featured the election of officers, remarks by Robert L. Anderson, Immediate Past President of the APWA, and by Robert Bugher of the Headquarters Staff from Chicago, and an explanation of the afternoon tours to the city's 2 million dollar water plant and river front development project by J. Schiltz, City Manager of Dubuque.

C. J. Anderson, City Engineer of Marshalltown, was elected President of the Chapter and Rex Matthews, City Engineer of Davenport, was elected Vice President. W. D. McElwee, City Engineer, Muscatine, was re-elected to the post of Secretary-Treasurer. Other members of the Executive Committee are: Lloyd A. Dove, City Engineer, Ames; E. H. Finch, Street Commissioner, Oelwein; Robert Price, City Manager, Ottumwa, L. H. Adams, Street Commissioner, Waverly, and the retiring president, Ken Cullen.

Painter Named President of Utah Chapter

Salt Lake City, Utah—The Utah Chapter of the APWA elected a new slate of officers at a Breakfast Meeting held in Salt Lake City in conjunction with the Golden Anniversary Convention of the Utah Municipal League.

Chapter President Joe L. Christensen, Commissioner of Streets and Public Improvements of Salt Lake City, presided at the meeting. Carl E. Painter, Consulting Engineer for the Waterworks Equipment Company of Salt Lake City, was elected President; B. E. Mellenthin, Assistant City Engineer of Salt Lake City, was named 1st Vice President and William D. Core, Superintendent of the Street Department of Ogden, was elected 2nd Vice President. Lyla Ray, Secretary-Treasurer of the League, was re-elected to serve the Chapter in the same capacity. Other members of the Chapter's Executive Committee include: Retiring President Joe L. Christensen; Lynn M. Thatcher,

OFFICERS: Sol Ellenson, Newport News, Va., President; Wm. D. Hurst, Winnipeg, Manitoba, Canada, Vice President. REGIONAL DIRECTORS: (term ending 1958) Jean L. Vincenz, San Diego, Calif.; Leo Flotron, Dayton, Ohio; Roy W. McLeese, Salt Lake City, Utah; (term ending 1959) Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D.; Frederick Crane, Buffalo, N. Y.; (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Texas. Immediate Past President, Robert Anderson, Winnetka, Ill. Donald F. Herrick, Executive Director.



● MEMBERS of the Virginia-District of Columbia Chapter at their recent meeting.

State Sanitary Engineer; Harold J. Tippetts, Davis County Surveyor, Farmington, Utah; and George Gudgeon, III, Consulting Engineer of Salt Lake City.

After the business session, the delegates attended the Municipal Waterworks and Sanitation Conference, which featured a talk on "Federal Grants for Municipal Sewage Treatment Plants" by Doren B. Boyce, Mayor of South Ogden and Vice Chairman of the Utah Water Pollution Control Board; a talk on "Charges for Sewer Service" by Richard R. Kennedy, Consulting Engineer, San Francisco, California; and a talk entitled "Sewage Disposal for Fringe Areas" by Win Templeton, Consulting Engineer of Salt

Lake City. The Saturday morning session was devoted to a talk on "Modern Demands on Waterworks Systems" by Charles W. Wilson, Superintendent, Department of Water, Salt Lake City; another on "Water Meter Repair Programs" by W. F. Richards, Director of the Ogden Water Department, and the presentation of a paper on "Coliform Bacteria Removal by Water Treatment Processes" by E. C. Garthe, Regional Engineer, U. S. Public Health Service of Denver, Colorado.

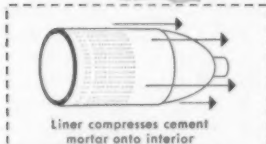
Virginia-D.C. Chapter Holds Annual Meeting in Richmond
Richmond, Va.—The annual meeting of the Virginia-District of

Columbia Chapter of the American Public Works Association was held in Richmond, Virginia, at the John Marshall Hotel, in conjunction with the annual meeting of the Virginia League of Municipalities. The meeting was attended by approximately fifty members and guests.

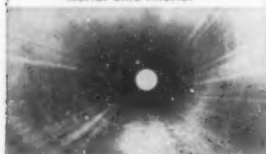
Members of the Chapter attended a hospitality hour on Monday evening, September 16. This was followed by a breakfast meeting on September 17, for the Board of Directors. At this meeting, various matters of interest to the future activities of the Chapter were discussed and plans made for the coming year.

The first item at the general session—presided over by the Chapter (Please turn to page 125)

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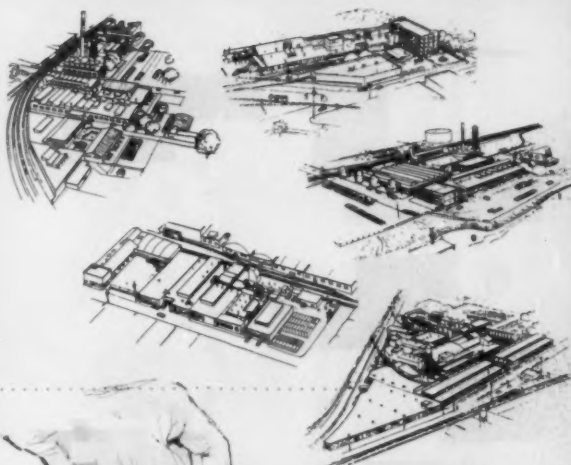
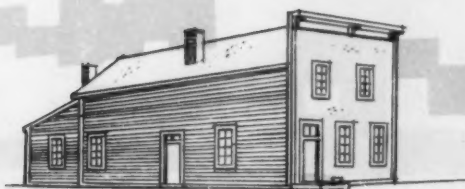
In 1857: Only one company in the United States was furnishing gas to its twenty-one customers; water sold for a penny a bucket from wagons; Hieronymus Mueller worked in a one-room, one-man shop in Decatur.

Today: Nearly 35 million Americans use gas for heating, cooking; more than 20,000 systems supply pure, fresh water to 130 million people; Mueller Co. is an organization with five modern factories, employing thousands of skilled craftsmen, manufacturing hundreds of quality products for water and gas distribution systems.

The water industry has made tremendous progress...the gas industry has had spectacular growth... Mueller Co. has kept pace with this march of progress!

1857

1957



engineering

New ideas—for new products and improvements on current products—are carefully analyzed and any with merit are passed on to trained project engineers for development. Approved designs are produced in the Mueller pattern shops by skilled craftsmen, and tested exhaustively—insuring performance in your equipment of tomorrow!



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As a major supplier of the equipment used by water works and gas companies, Mueller Co. research, engineering and manufacturing facilities are constantly striving to solve your problems of the future...and the answers are being found! New products, methods and equipment are being developed, current ones are being improved to further aid the growth of our vital water and gas industries.

research

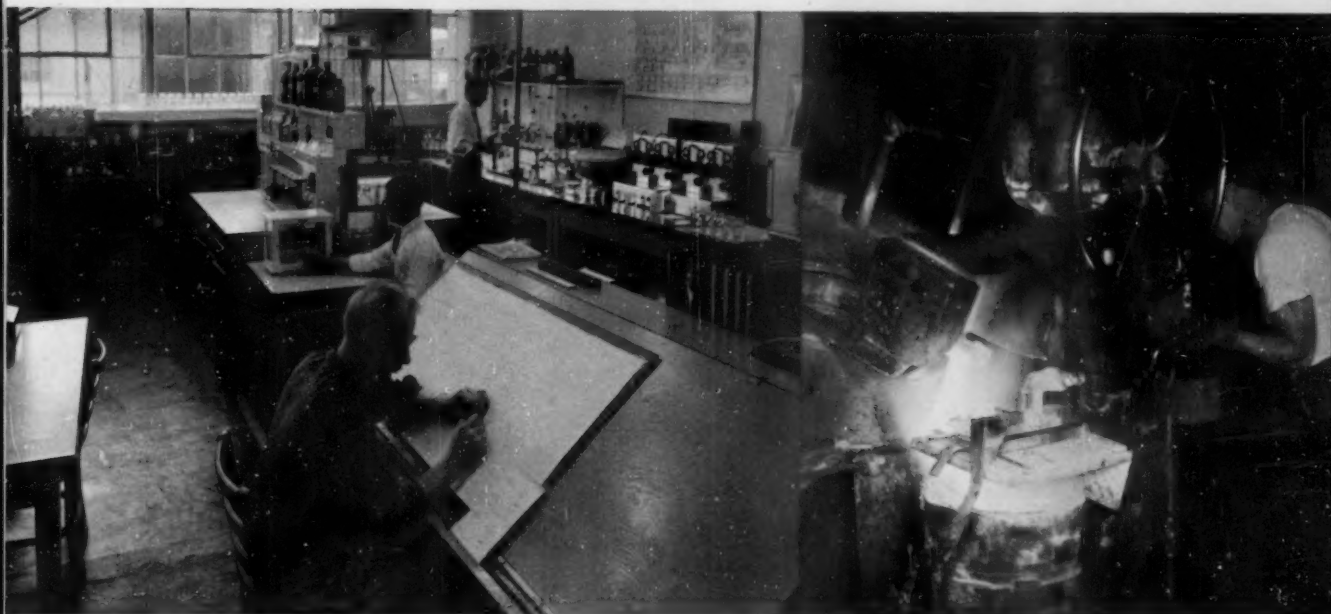
Metals, and other materials used in the manufacture of Mueller products, are subjected to rigorous tests and checks by laboratory technicians.

This constant search is for improvements to provide longer life and safer operating methods in the products you are using today and tomorrow.

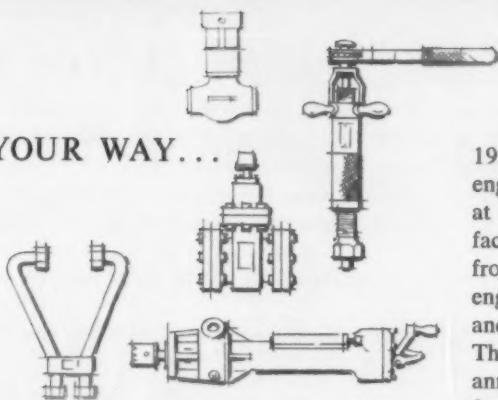
manufacturing

Production methods are under study at all times to gain greater accuracy and quality. New machine tools and equipment are constantly being added to Mueller plant facilities to add still more precision to Mueller products.

Dependability—today and in the future—is assured!



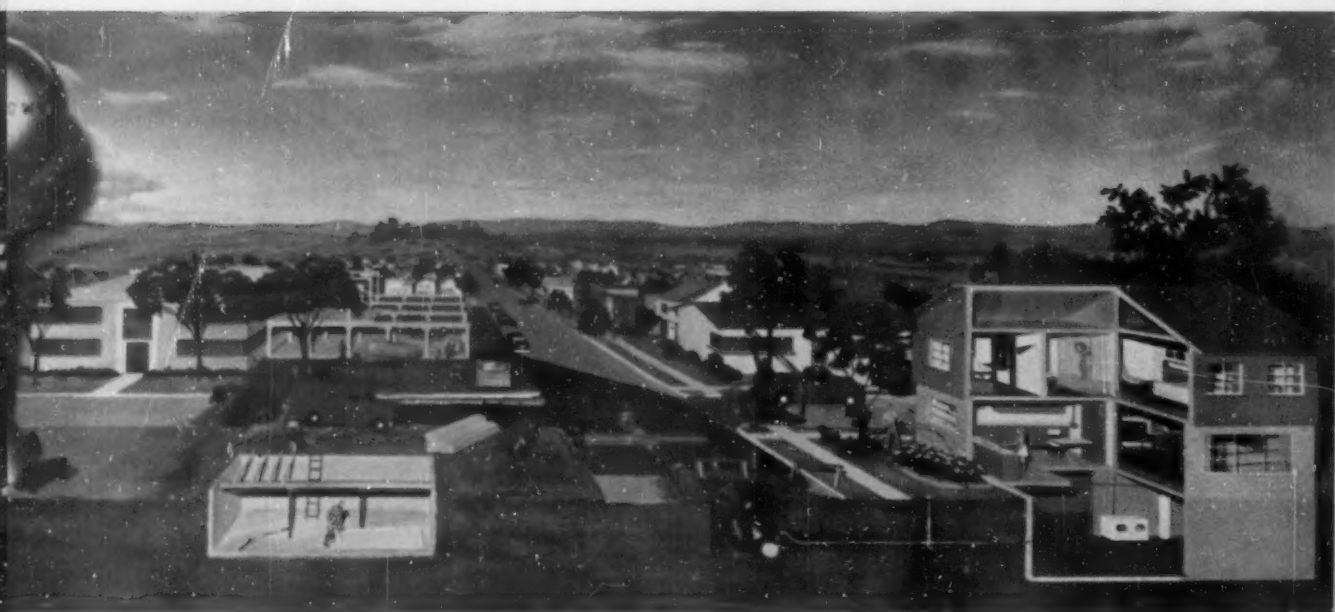
COMING YOUR WAY...



1957 was a year of spectacular engineering accomplishment at Mueller Co. New engineering facilities were dedicated and from the boards of an expanded engineering staff came new and improved products. These products will soon be announced, and will be ready for you in '58!



"Watertown, U.S.A."...is a miniature city produced by the almost-lost art of diorama. Each tiny detail is reproduced in exact scale for its position in the scene and is proportioned to correspond to the overall "bird's eye" view. The perspective of each item is exaggerated to create an optical illusion which amplifies the depth. Through this means, a view of approximately 20 miles has been reproduced in less than 48 inches.



unseen...unheard... UNDERGROUND!

Vital as the water and gas industries are, they receive little recognition for the vast facilities they must provide to serve their customers. Their products and their service systems lie underground—unseen and unheard.

Yet the story of these underground facilities is both dramatic and interesting to the general public. People have a more definite respect for the problems of the gas and water industries when they see the maze of equipment beneath their towns.

To help tell this story, Mueller Co. has prepared "Watertown, U.S.A."...a spectacular diorama that shows the work and facilities necessary to serve a community.

This is just one more way that Mueller Co. is looking to the future—the future of the vital industries which it serves!

MUELLER CO.

Factories at: Decatur, Chattanooga, Los Angeles;
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DECATUR, ILL.

Since 1857

President J. D. Wright—was a round table discussion of problems of refuse collection, disposal and street cleaning. This panel was moderated by Donald S. Frady, Director of Public Works, Falls Church. Members of the panel were Whitworth Cotton, City Engineer, Petersburg; and W. L. Rothgeb, Deputy Director of Public Works, Alexandria. Following this panel was a round table discussion on programming of safety for municipal operations. This panel was moderated by Ernest L. Clements, Chief, Division of Sewer Maintenance, Department of Public Works, Richmond, and the panel members were James T. Wadkins, Managing Director, Richmond Area Safety Council; and Allen P. Fulton, Chief, Bureau of Business Management, Department of Public Works, Richmond.

At this meeting, all phases of safety programming for municipal operation were discussed and the question and answer period which followed was of considerable interest to all members attending the meeting.

The panel discussions were adjourned at noon, and were followed by a luncheon meeting of the membership and guests of the Virginia-District of Columbia Chapter. The following officers were elected to serve for the coming year: President, Robert Hopson, Director of Public Works, Richmond, Virginia; Vice President, William Xanten, Superintendent of Sanitation, Washington, D. C.; Secretary-Treasurer, John C. Crocker, Staff Member, Office of Urban Renewal, Washington, D. C.; and Directors for a two year period, Whitworth Cotton, City Engineer, Petersburg, Virginia; and David W. Auld, Director, Department of Sanitary Engineering, Washington, D. C.

Texas Chapter Elects New Slate at San Antonio Meeting

San Antonio, Texas—C. C. Crutchfield, Executive Director of the League of Texas Municipalities and Ex-officio Secretary of the Texas Chapter of the APWA, reports that Drahn Jones, Director of Public Works of Corpus Christi was elected President of the Chapter at its recent meeting in San Antonio on September 30. Mr. Jones takes over the top post from J. P. Burden, City Engineer of San Angelo, who remains on the Chapter's Board of Trustees.

Others elected to office were: M. M. Anderson, City Engineer, Abilene, Vice President; W. A. Satterwhite, Chief Engineer, Fort

Veteran operator Delbert Corman "at ease" while his Cleveland is digging gas and water lines for a Lexington, Ky. subdivision



Cleveland's exclusive multi-speed transmission provides right power/speed ratio for every job

"For easy handling and dependable digging even under the toughest trenching conditions give me a Cleveland every time," says long-time heavy equipment operator Delbert Corman of Aldridge & Poage Co., Lexington, Ky., owners of 3 Cleverlands. Thousands of trench operators and owners throughout the world agree with him. Credit for this worldwide preference for Cleverlands is due to the perfectly balanced combination of practical performance-proved features found in every Cleveland. Practically every modern trencher feature originated with Cleveland. But no single trencher feature ever developed is the equal of Cleveland's exclusive multi-speed crawler transmission.

For each of 4 digging wheel speeds this transmission provides 12 individual crawler speeds forward and 12 reverse, all closely and evenly graduated. The 48 forward speeds give the operator a choice of over 30 practical digging speeds—over 30 usable combinations of digging wheel and crawler speeds, providing the *right* combination of power and speed for digging every soil, under every digging condition. The following table of non-slipping, power-saving digging speeds for the Cleveland 95 is typical.

Cleveland's exclusive multi-speed transmission has no equal

For each of 4 wheel speeds		there are 12 individual crawler speeds											
With Main Transmission (and Digging Wheel) in		SPEEDS (in Feet per Minute) — Available in Either Direction (Bold Face Indicates Most Commonly Used Digging Speeds)											
First Speed		.5	.7	1.1	1.5	2	2.8	3.4	4.7	5.9	12.6	22.5	38
Second Speed		1	1.4	2.2	2.9	3.9	5.3	6.6	9	11.5	23.8	43	73
Third Speed		2	2.8	4.3	5.8	7.8	10.6	13.3	17.9	22.8	47	86	146
High Speed (Ordinarily used when digging)		3.3	4.6	7.1	9.5	12.8	17.5	21.7	29.6	38	78	143	240
Reverse (not used when digging)		.4	.6	.9	1.2	1.6	2.2	2.7	3.7	4.8	9.9	18	30

THE CLEVELAND TRENCHER CO.

20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO





● **APWA MEMBERS** who participated in a special inspection trip to New York City's South Shore incinerator following the 1957 Public Works Congress and Equipment Show in Philadelphia. The trip was sponsored by Combustion Engineering Company.

Worth, Treasurer; T. Spencer Love, City Engineer, Southside Place; and Sam Granata, Jr., Director of Public Works of San Antonio. The annual meeting of the Chapter is customarily held in conjunction with the Municipal League Convention. Next year's meeting will be held in Houston.

Michigan Members Select Pontiac Official for Top Chapter Post

Ann Arbor, Mich.—The Michigan Chapter of the APWA held a luncheon meeting in Ann Arbor, October 24, and elected a new slate of officers for the coming year. J. B. Jewell, Superintendent, Department of Public Works of Pontiac, was named President and Howard L. Lilley, City Engineer of Dearborn, was elected Secretary-Treasurer. Fred

R. Cheek, City Engineer, St. Claire Shores, became 1st Vice President; C. A. (Chick) Johnson, Director of Public Works, Midland, 2nd Vice President and George L. Nampa, Director of Public Works of Royal Oak, was elected 3rd Vice President.

The members thereafter went on a tour of the Civil Engineering Laboratories and the new North Campus, which was sponsored by the Michigan Municipal League in cooperation with the Civil Engineering Department of the University of Michigan, and the Michigan State Highway Department. The tour was followed by a reception at the American Legion Club and a joint dinner meeting with the Southern Michigan Public Works Forum. Professor John C. Kohl, Director of the Transportation Institute of the Uni-

versity of Michigan, was the principal speaker. Arrangements for the meeting were made by Ralph E. Speer, Jr., Staff Engineer of the Michigan Municipal League.

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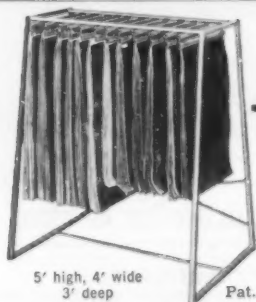
Calculators Save Time For County Highway Department

(Continued from page 109)

few years later, they authorized the purchase of the second, in order that each of the office clerks could have a machine at their side in their checking and accounting work.

The adding machine is an old fashioned machine, operated manually, which we hope to trade in for an electric model at an early date. Actually, in our work, the adding machine is supplementary to the calculators. Its function is primarily

Holds 1800 Blue Prints



5' high, 4' wide
3' deep

Pat. Pend.

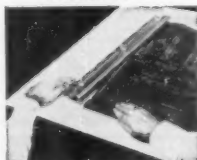
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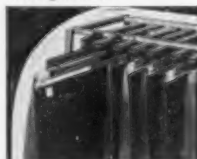
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All-steel Gliders, finished in a handsome grey, harmonize with modern office equipment. Extensions are available.

For longer print "life" and for efficiency, durability and economy in vertical filing, specify Glider. Order now through the best office suppliers or write for illustrated literature.



Through the direct clamp design of plan holders, you slip sheets, either singles or sets, in or out without removing others.



Plan holders "glide" in on steel tracks, are secured from end-to-end, and "glide" out with little effort.

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VALLEY LIGHTWEIGHT STEEL PIPE

Manufactured in new, modern continuous mills to specifications per ASTM-A139 Grade B; which also conforms to API 5L standards. Automatic electric butt weld process, using submerged arc. Pressure tested. Ideal for use as line pipe for gas and oil, for municipal water systems and irrigation, high velocity tubing for air conditioning and heating, heat exchangers, well casing, grain and mineral spouting, as well as many other manufacturing and industrial uses.

Available in 6", 6½", 8", 8½", 10", 10½" diameters, from 16 gauge up to and including .188 wall thickness; 20, 30 or 40-foot lengths; and in plain or beveled ends. Quotations available for Victaulic or Dresser end processing, and coating.

Available for immediate delivery.

VALLEY

Write or call for full specification and production data to: **Steel Pipe Division**

Manufacturing Company Valley, Nebraska

Self-propelled Tractairs with attachments "give us mobility and utility we never had before," says Supt. Anglin. "Without them, we would have a tough time keeping up with the booming demand for water service."



Tractairs* Save \$24,000 a Year in Labor Costs

"We can put in water service lines 300% faster with Le Roi tractor-compressors," water dept. superintendent reports

Three self-propelled Le Roi Tractairs with attachments slashed the annual cost of labor for laying and maintaining water service lines from \$32,000 to \$8,000. That's the report of Charles Anglin, Superintendent of the Water Dept., Mansfield, Ohio.

Today, Anglin explains, four men with a Tractair finish a water-tap job in four hours. In the past, the same job tied up ten men, a truck, and a portable compressor for two days. That's quite a saving when you consider that Mansfield installs 500 new water taps each year.

Rely Solely on Tractair

Water-main repairs are routine jobs now, he adds. "We can fix a break and restore service 50% faster than before we had the Tractairs," he explains. That's because the Tractair gets to the site in record time — brings the air supply and all the tools needed under its own power.

The LeRoi unit breaks the surface. It digs the trench with its back hoe attachment while water is flowing, and powers the sump-pump to remove excess water. After the break is repaired, the backfill blade is used to refill the trench. Tampers pack the fill, using air from the Tractair.

Each Tractair replaces four pieces of equipment, some of it rented — when available — at \$15 an hour. Labor, at \$2 per man/hour, is reduced from ten men to four. And, since the Tractair is self-propelled, there's no waiting for equipment to be hauled to or about the site.

Provides Many Benefits

The utility and mobility of the Le Roi tractor-compressors raised job completions from one every two days, to four a day. Water shut-off lasts only a few hours — not all day or all night. Fire hazards are greatly reduced, and interruptions of street traffic are minimized.

Tractair can help you improve water service and cut labor costs. The attachments can save you thousands of dollars by eliminating the need for costly one-purpose equipment. Look into it today.



On-the-job air power shortens hose lines and provides full power for tools. Different tools can be operated at the same time.



Back hoe attachment turns Tractair into a digger. At Mansfield, attachment replaces eight pick-and-shovel laborers.



Backfill blade covers trench after break is repaired or tap is laid. Formerly, job was done with hired dozer and operator.

*"Tractair" is the registered trademark for Le Roi's combination tractor — air compressor.

W A R C O



LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of Newmatic air tools, portable and Tractair® compressors, stationary air compressors, and heavy-duty industrial engines. Write us for information on any of these products.

to provide us with a written record of the figures used in the transaction either for record or for checking. Ordinary addition and subtraction of the routine of checking bills and ordinary cost accounting are handled with the calculators.

Our regular procedure is to close our accounts on the 25th of each month, and have all bills submitted for processing. As they come into the office, they are checked for correctness in extension, the discount taken, and the bills put in form for approval. The calculators here prove their worth in the fact that they are versatile, they multiply or divide to determine unit or total cost and then can add up the total bill and deduct the credits to determine the net payment due.

On cost accounting they again prove their value as we are able to take the reports of some 35 or 40 field men and reduce their daily operations into unit costs at a high rate of speed. Perhaps not the least of their versatility is the simple fact that they never miss the decimal point with an operator who is trained always, regardless of the type of computation, to put his items into the machine properly. The habit of correctness in entering the items into the machine reduces the chance

of error in rush work as it becomes automatic to do it correctly.

Calculators Used in Design

In our design work the calculators again are called into use. In our road work, grades are computed and extended to stations and fractions of stations without the laborious work and possibility of error so common in additions, subtraction, multiplication and division work done mentally or by hand on paper. In estimating and computation of quantities we save time by setting up our problem on paper, listing all equations in each detail of work. We then make the total computations with the calculator. This saves the laborious hand work that is fraught with the dangers of mistakes when computations must be made in the midst of interruptions so common in the average county engineer's office. Also, we find that we are less liable to omit an equation if we concentrate on setting up all equations in a logical order and not dividing our time between determining an equation, computing it out, and then returning to determine the next equation—a method usually followed by hand calculators to break the monotony of endless hand and mental computations.

We do not attempt to do all our blue or black line printing with our reproducing machine. We utilize it only for our emergency and single print work. We find we do not have sufficient work to set up the machine for large jobs, but with our commercial printing service several days off, we cannot afford to risk our original tracings on the job, nor wait to send off an emergency job. Consequently, we feel that our small Victoray printer is adequate for our use.

It is our custom in Marion County to prepare a comprehensive annual report wherein we give to the County Commissioners and to the public a total picture of our operations for the year. This report reduces down to average costs the various types of work and the main component parts of the work. We would not attempt to make such a report without the assistance of calculators. We not only must add all similar types of work into one master project, but we must then break the total project back down into average costs of the various phases of the work. We believe this report is a valuable contribution to our records, because it gives us a searching picture of our work as well as explaining to the County Commissioners and to



POWER LINES ARE VULNERABLE

Wherever there may be a tornado, earthquake, flood or other disaster the saving of many lives and millions in property damage can be accomplished by fast restoration of power.

Within SECONDS of power failure Synchro-Start Controls activate any stand-by engine to produce emergency power for vital utilities such as, fire protection, communications, light and refrigeration. When main line power is restored the controls quickly transfer the load.

SYNCHRO-START PRODUCTS, INC.

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SURVEY MARKING and IDENTIFICATION EQUIPMENT

BATHEY SURVEYOR STAKES AND IDENTIFICATION CAPS

- A Permanent Marker
- Professional Advertising
- Dip Needle Response
- Five Lengths
3", 18", 24",
36", 48"



BENCH MARK



Permanent Solid Brass
Marker for Setting in
Concrete

HEAD
2 1/4" Dia.
1/8" Thick

B-13

WRITE FOR LITERATURE

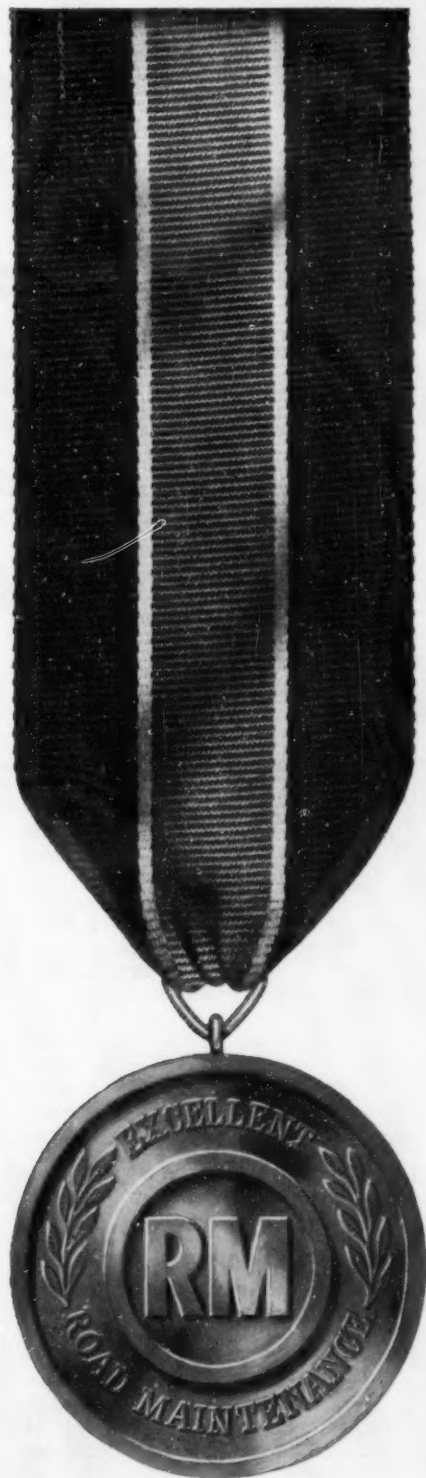
BATHEY MFG. CO.

100 S. MILL STREET

PLYMOUTH, MICH.

Road maintenance men deserve a medal

(especially in winter!)



The importance of efficient maintenance men is gaining in recognition and respect every year.

The constant increase in vehicular traffic points to the excellent job maintenance men do in summer and especially in winter.

Not only is the public dependent upon the performance and planning of these men, but the economic health of many communities lies in their judgment.

- According to the National Safety Council, accidents due to skidding increase 35% when effective ice control is not practiced.
- A compendium of business reports indicates that retail business falls off as much as 80% when snow and ice cause dangerous driving conditions.
- In a 17-state study, it was found that revenue from gasoline taxes falls off 30% in icy weather when driving is hazardous.

These are but a few of the strong arguments for keeping traffic-ways safe during ice and snow. The fine record of experienced maintenance men points to excellent performance in protecting public safety and in guarding the economic prosperity of the communities.

Now is the time to order Columbia Calcium Chloride for treating abrasive stockpiles, and to have supplies on hand for application with salt at the first winter emergency.

Columbia Calcium Chloride shipments are now being made daily for winter use. We would appreciate the opportunity to serve you. Why not call or write now.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
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IN CANADA: Standard Chemical Limited and its Commercial Chemicals Division

LOOK! A Dozen Water-Sewer Problems H-3 Hydrocrane Solves Them All



**BUCYRUS
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PROBLEM	HYDROCRANE SOLUTION
1. Travel time between jobs.....	Up to 50 mph travel speeds
2. Frequent setups	Hydraulic outriggers that set in seconds
3. Close quarter work	Shortest tail swing in its class
4. Frequent boom angle changes.....	Working boom hoist
5. Lift heavy loads.....	New 5-ton H-3
6. Inexperienced operator	Clearly marked hand levers—no foot brakes
7. Dig trench and lay pipe.....	Convertible to crane, clamshell or Hydrohoe
8. Excavate short, deep pits.....	Hydraulic clamshell or H-3 Hydrohoe utilities dipper
9. Reduce damage to buried obstructions.....	Hydraulic precision of control
10. Stockpile light materials.....	Light materials buckets
11. Work on rough, irregular terrain.....	Hydraulic outriggers level automatically
12. Downtime	Simplicity of design cuts costly maintenance

Yes, Hydrocranes are the only crane-excavators that do so many jobs so well. Mounted on a new or low-cost used truck, the 5-ton H-3 is the high-speed digging and lifting package that returns more per dollar invested than any other machine in its class. Your Bucyrus-Erie distributor will be pleased to present the whole Hydrocrane story.

2034157

Bucyrus-Erie Company • SOUTH MILWAUKEE, WIS.

the public how their money is being spent.

While we do not put our calculators to their maximum use, since our operators are not specialists in their use, we do continually find new jobs where they can save time or, more important, be more accurate. It is a simple process to extract the square root with the machine, and equally simple to prove the answer by reversing the procedure. We find in checking bills, that bills checked by hand are often approved because they appear correct, but with the calculator it is a simple and quick procedure to feed the information into the machine and know they are correct. In our re-survey work it is equally simple to reduce chains, and rods, of old surveys into feet to accommodate the modern methods of surveying.

In transferring elevations and other surveys, notes can be quickly computed or checked each night with the calculator. We often make calculations for the shop or field men when they have a geometrical problem with one side missing.

These calculators are never valued so highly by the office staff nor missed so sorely in our every day operations, as when they are out of service for their annual cleaning and checking by our contracted maintenance firm. We believe a machine so complicated as a calculating machine needs regular maintenance by competent mechanics. This contention is proven correct because even though one machine is over ten years old, we seldom, if ever, have it out of service for repairs between check-ups.

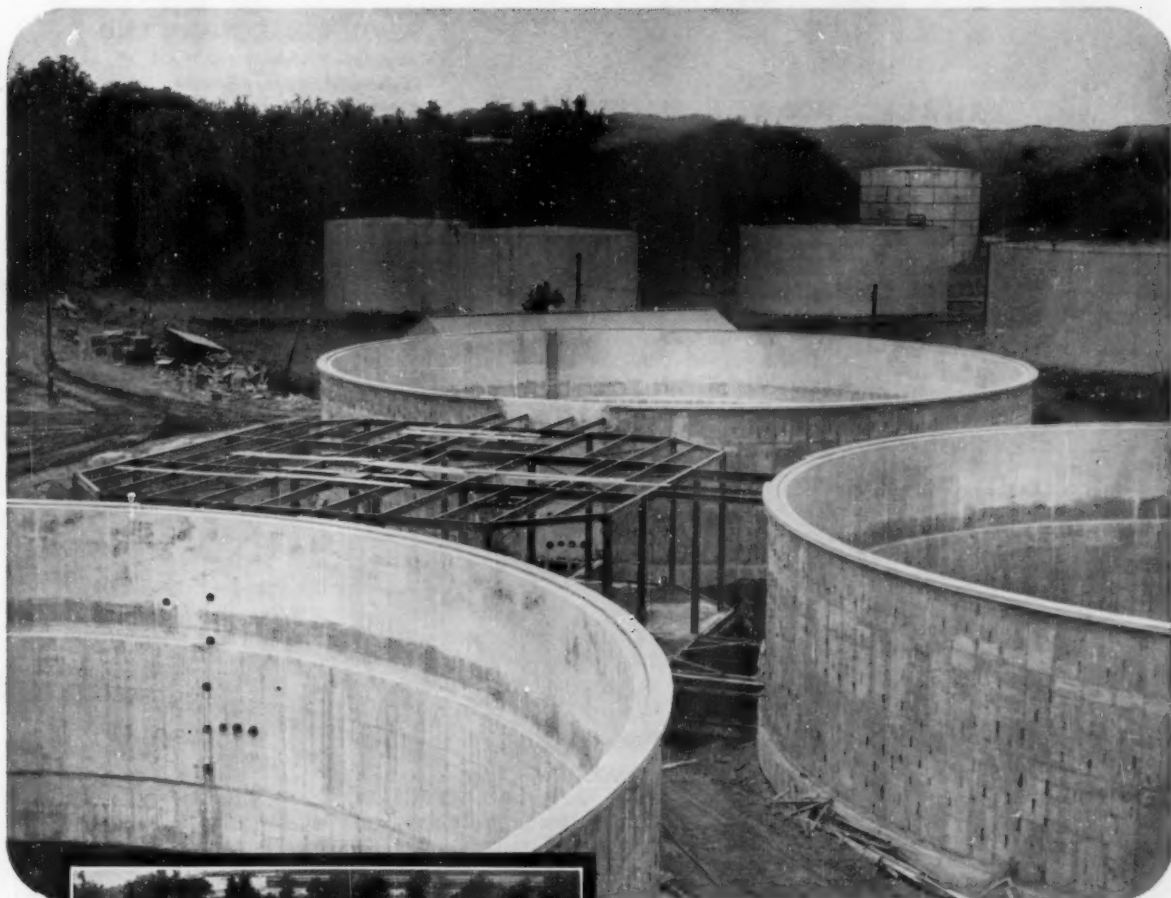
Without doubt, and as much as air conditioning is appreciated, I am confident that our office force would prefer to lose their air conditioning, even in the 100 degree weather we are experiencing at the time of writing this article, before they would lose their calculators. I know of no device available to the modern county engineer's administrative office, that will speed up and yield more accurate work than the calculating machines.

• • •

Refuse Containers Tagged

Containers for garbage and trash which are of the wrong size, have ill-fitting lids, contain materials which are prohibited from collection by ordinance or are otherwise unacceptable are tagged by collectors of the Baton Rouge, La., Department of Public Works. Standard containers improve efficiency.





Louisville builds concrete sewage treatment plant *for 1977*

Shown here are views in the construction of the Louisville, Ky., \$6 million concrete sewage treatment plant. It is designed for a 100 mgd flow in dry weather and a storm flow of 338 mgd. An expected 40% population increase to 570,000 in 1977 has been taken into consideration.

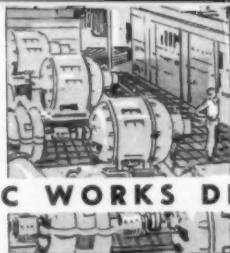
The plant was designed by Metcalf & Eddy, consulting engineers of Boston and constructed by Gust K. Newburg Co., Chicago.

Concrete is the ideal construction material for sewage treatment plants. It offers: (1) *unusual durability* to resist severe weathering, decay, termites and fire; (2) *great strength* and (3) *real economy* due to moderate first cost, low maintenance cost, long life and low annual cost. Ask for free booklet on financing sewage treatment works. Distributed only in United States and Canada.

PORTLAND CEMENT ASSOCIATION

Dept. A12-89 33 West Grand Avenue, Chicago 10, Illinois

A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work



PUBLIC WORKS DIGESTS

Prepared by

ALVIN R. JACOBSON, Ph.D.

Associate Professor and Head,

Division of Sanitary Science,

Columbia University School of Public Health

THE WATER WORKS DIGEST

Submersible Booster Pumps

The use of submersible motor pump units offers a satisfactory method of overcoming problems encountered when the installation of a booster pumping station is proposed in a residential area. They eliminate much of the noise; and they can ease or eliminate the problem of design and construction of a building to house the pumps. The pump and motor unit are set in a vertical section of pipe as shown in a typical installation herewith. The submersible pump was developed to meet the problems of installation in very deep wells. The general characteristics of the various types of submersible pumps, i.e., wet-stator, dry-stator, oil-filled open winding, and plastic impregnated stator winding types, are discussed. The use of the submersible pump has become quite common in the western states, due principally to the fact that they are exceedingly economical, especially when the estimates include the cost of the necessary protective building for a pump installation where a conventional motor is used.

"Submersible Pump Applications in Booster Pumping." By R. C. Kenmir. *Water and Sewage Works*, October, 1957.

Corrosion Prevention

This article is a report of some of the results and conclusions of a continuing study of corrosion and tuberculation of cast iron being made by the Illinois State Water Survey with the support of a research grant from the National Institutes of Health. The general conclusion is made that calcium in the presence of alkalinity, regardless of pH or saturation index, is an effective inhibitor to corrosion. The basic corrosion reaction is conducive to the formation of calcium carbonate which acts as an inhibitor and the rate of deposition is increasingly improved with higher concentrations of calcium. The rate is also improved by increased velocities which bring

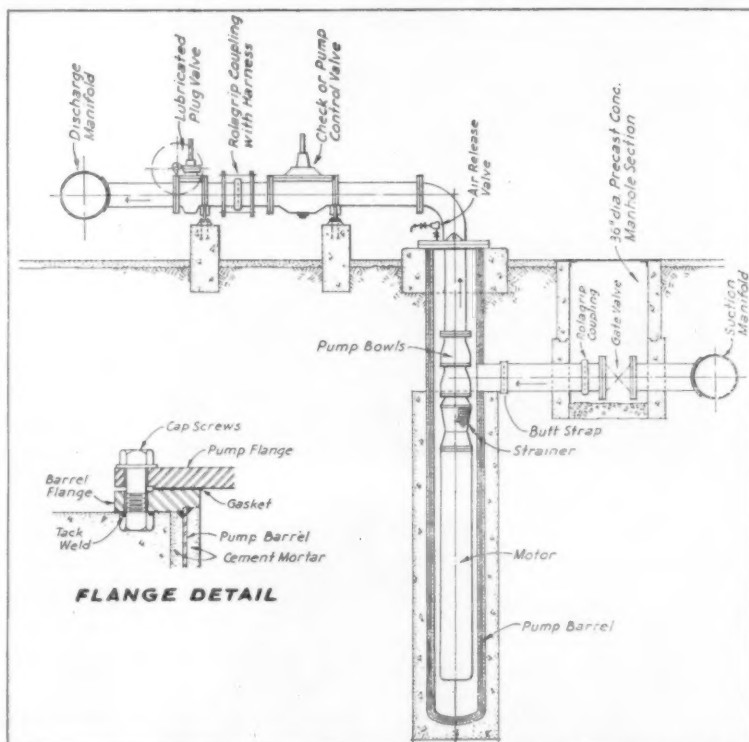
about better diffusion of the inhibitor. Tuberculation may occur where the inhibitors are present in insufficient concentration to produce complete protection against corrosion. It may be tentatively concluded that the problem of designing water treatment to avoid tuberculation of cast iron is limited to such waters that already contain inhibitors but of insufficient concentration to provide complete protection.

"Corrosion and Tuberculation of Cast Iron." Thurston E. Larson and R. V. Skald. *JAWWA*, October, 1957.

Chlorination Without Filtration

For 16 years the use of high chlorine dosages and the maintenance of high residuals has given the City of Duluth, Minn., a safe water supply without recourse to filtration. The

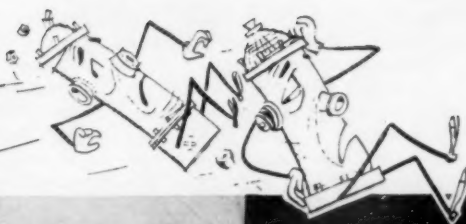
Lake Superior water is treated by pre-chlorination and detention before pumping into the distribution system. The annual average raw water coliform counts are quite low, varying from an MPN of 4.1 to 30.7 per 100 ml over the 16-year period. The effect of preammoniation and chlorination (chloramine residuals of 0.4 ppm) was tried from June, 1939, to August, 1940, when it was discontinued. During this period, there were 28.1 positive portions per 1,000 samples. Thereafter a free chlorine residual of 0.4 ppm was maintained until 1948, after which time a residual of 0.6 to 0.8 ppm was preferred. Under these conditions, there were 0.59 positive portions per 1,000 samples. The bacteriological results during the 8-year period 1948-56 on 72,952 100-ml portions showed 11 coliform positive, or 0.15 per 1,000 samples. The re-



Courtesy Water & Sewage Works

● TYPICAL installation of a submersible booster pump for a well is shown here.

OUT THEY GO!



and
IN go
EDDY
HYDRANTS

Many of the 650 fire hydrants in Maywood, Illinois (pop. 30,000), have been in service 40 years or longer. Some were no longer being manufactured, and repair parts were unavailable. In a decision to modernize its hydrants, Maywood decided to standardize on Eddy hydrants in 1954—to simplify servicing, cut maintenance costs, reduce parts inventory, and assure service for the future.

Eddy hydrants had proved highly satisfactory in Maywood's 50-mile system, and repair parts have always been available. Under the aggressive direction of public works director Bazil E. Crowe, above left, the replacement program, has proceeded at a fast, economical rate, with more than 170 hydrants replaced in 1956 alone.

it's the safest, most economical course!



EDDY **AWWA (UNDERGROUND) VALVES**

Everything in AWWA valves for underground use in your waterworks system is quickly available from Eddy—gate valves; cutting-in valves and sleeves; tapping valves and sleeves. And, remember, Eddy's more than 100 years' dependable operation is your assurance of service far into the future.

Maywood feels that it cannot risk hydrant failure, nor afford the sky-high cost of handmaking individual repair parts for obsolete, "orphan" fire hydrants. Can you?

Based on the experience of this and other alert communities, your city or village might do well to take stock of its hydrant situation. If so, an EDDY man will be very glad to give facts and figures you will find most helpful in making a wise decision. Won't you invite him to see you . . . soon?

AWWA EDDY BRONZE-MOUNTED HYDRANTS

EDDY Bronze-Mounted HYDRANTS open smoothly with the pressure and close without water hammer. One man can easily remove all operating mechanism for inspection and repair. Positive drip action automatically drains the standpipe, safeguarding against freeze-ups. Stem held in place below hydrant valve means that there is no water loss due to a bent stem.



EDDY VALVE COMPANY

A Subsidiary of James B. Clow & Sons, Inc.

WATERFORD
NEW YORK

sults confirm the conclusions of many investigators that properly controlled chlorination, when considered in conjunction with pH, may be very effective in producing a coliform-free water.

"Chlorination of Raw Lake Superior Water Gives Duluth 'Superior' Water." By Earl H. Ruble. *Water Works Engineering*, October, 1957.

Plastic Water Pipe

The water works of the town of Dunnville, Ontario, with a population of about 5,000 has been using

plastic pipe for its water distribution services for the past six years with excellent results. The water is quite variable in its characteristics, causing severe rusting in iron mains. The topography and soil characteristics and the variable pressures and temperatures put a real stress on any pipe in this community. The first section of plastic pipe was installed in 1950 as a temporary arrangement serving 11 homes. Since that time, additional plastic pipe of various sizes from 3/4 to 2-inch has been installed until at the present time about 5½ miles are in use. No diffi-

culty has been found with the pipe itself but there has been considerable trouble with connectors and clamps. The original plastic connectors failed on two points; that is, they either broke or they absorbed water and swelled. This swelling caused the connections to leak and all of the pipe had to be dug up so that these connectors and clamps could be replaced with new fittings which were invented in their own shops. The plastic service lines have been highly satisfactory but they still have one difficulty—that of frozen pipes for which no satisfactory method of thawing them has been developed.

"Plastic Pipe for Water Services." By John P. Dawson. *Water and Sewage Works*, October, 1957.

Fulfilling Growing Water Needs

Wilmette, Illinois, near Chicago, has embarked on an extensive rehabilitation and expansion of its water system. The completed plant will have a rated capacity of 15 mgd. serving an area which includes corporate Wilmette, the adjoining village of Glenview, and the nearby Glenview Naval Air Station. By 1980, the estimated total population will be approximately 47,000 with a per capita consumption of about 125 gallons. Besides a peak demand of 15.2 mgd, the new water system must also provide a fire reserve of 7.3 mgd in 1980, based on the standards of the National Board of Fire Underwriters. Raising the plant's rated capacity from the original 6 mgd to the 15 mgd capacity required the installation of two new mixing-settling basins on a dual-level arrangement. These were designed with the mixing and the second half of the settling operation taking place on the upper floor and the primary settling taking place on the lower level. The advantages of this arrangement are the elimination of cross-circuiting and reduced expense of excavation. Other major improvements include improved methods of handling chemicals, including chlorine, extensive changes in both the low-lift and high-lift pumping equipment, the installation of a 4-million gal. capacity standpipe and a new 3,475 gpm booster pump.

"Growing Population Demands a Modern Water System." By Phil Hirsch. *PUBLIC WORKS*, November, 1957.

Other Articles

"Telemeter Controls Operate 23-Well System." *PUBLIC WORKS*, November, 1957.



Overshadowing the now inadequate storage facility it replaces, this modern elevated structure places 300,000 gallons of water in reserve to meet demands of Parkville Water Co. customers.

Cost estimates available on request

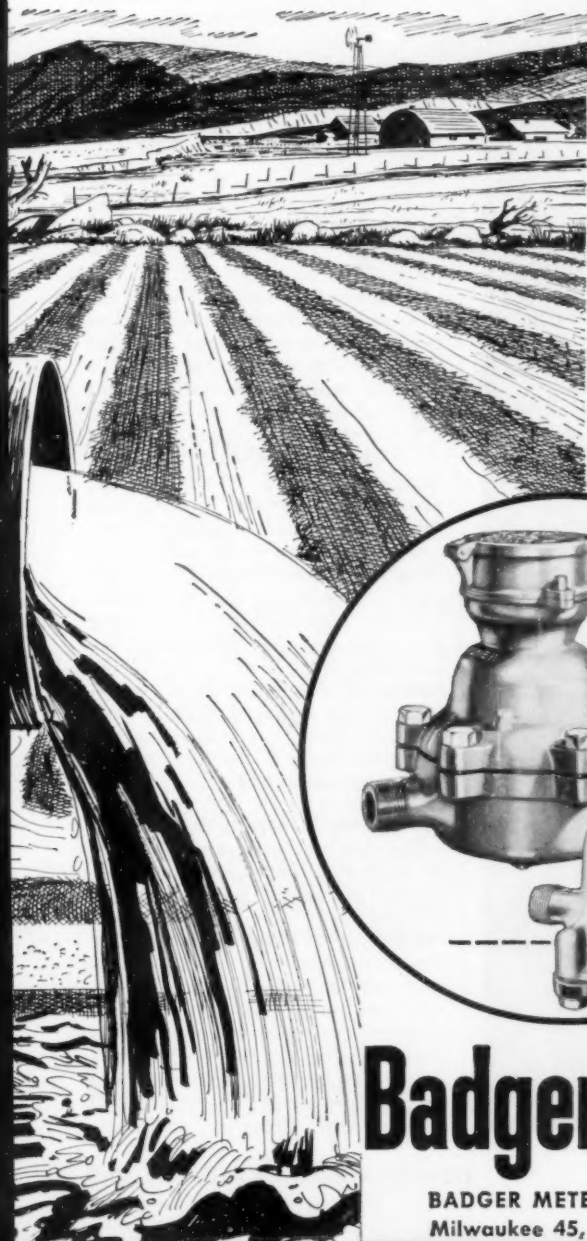
THE DARBY CORPORATION
Kansas City Kansas





Soil conserved...

but how about our most precious possession...water?

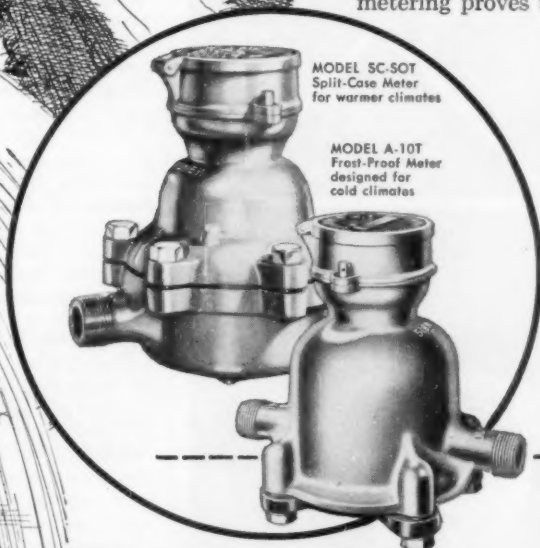


Stop water waste...start water conservation now—with Badger Meters

We are paying billions for land conservation and reclamation because our very life depends upon it. And we are lucky — there's land to reclaim. But what about our diminishing water supply? When that's gone — then what?

That's why the time to start water conservation is *now*—with Badger Meters. They're the best investment you can make for your community's future. Badger Meters replace impractical and unjust flat rates with a fair-share, fair-pay program for everybody. Accurate metering proves to consumers that the best things in life are far from free. *That's* when water waste stops — conservation begins. What's more, Badger Meters put your water system on a profitable, business basis.

Choose the specific meters you need from the complete Badger Meter line of outstanding disc, turbine and compound meters — 5/8-inch through 12-inch sizes. They're precision-engineered, using the finest alloys for lasting, accurate service. Call a Badger Meter representative for facts — or write for literature *today*.



Badger Water Meters



BADGER METER MFG. CO. • 2371 North 30th Street
Milwaukee 45, Wisconsin • OFFICES IN PRINCIPAL CITIES

"Drive-In Service for Water Bill Payment." By Max Holland. Public Works, November 1957.

"\$200 Million for More Water for 4,000,000 More People." By Robert B. Diemer. Water Works Engineering, October, 1957.

"Using Reservoirs for Recreation." Resume of a panel discussion at the AWWA convention. Water Works Engineering, October, 1957.

"How to Maintain Pipe Line Coefficient C." By Wm. D. Monie and H. B. Scales. Water Works Engineering, October, 1957.

"Some Operational Problems of the Small Water Works." By Foster S. Burba. Water Works Engineering, October, 1957.

"Experience in Applying Fluorides." A panel discussion presented at the 1957 AWWA Conference with John R. Baylis, Chairman. JAWWA., October, 1957.

"Recruiting and Training of Personnel." By W. A. Hardenbergh. JAWWA., October, 1957.

"In-Service Training and Certification." By Raymond A. Faust. JAWWA., October, 1957.

"Techniques in the Use of Liquid Alum." A panel discussion presented at the 1957 AWWA Conference. JAWWA., October, 1957.

"Carbonation of Water Softening Sludge." By F. A. Eidsness and A. P. Black. JAWWA., October, 1957.

"Factors Affecting Long Distance Transmission of Water." By Louis R. Howson. JAWWA., October, 1957.

"Small-City Water Supply Planning." By George M. Reece. The American City, October, 1957.

"Malvern Updates its Water Works Plant." By Wayne Davis. The American City, October, 1957.

Roadside Parks

(Continued from page 102)

and rest areas will be from thirty to forty miles. The size of these turnouts should be a minimum of three acres.

3. The safety turnouts and rest areas are to be a combined facility, as indicated by the name, and provision shall be made for both passenger cars and trucks.

4. The areas should be far enough removed from interchanges to avoid any confusion in signing and so that the turnout signing will not distract drivers' attention from directional and route markers.

5. The safety turnouts and rest areas should, as a general rule, be constructed in pairs. The pairs may be built opposite; however, it may be desirable to stagger the areas so that the driver will approach the turnout on his right first.

6. Turnout drives shall be so located as to provide an island between the traveled lanes and the turnout drive of not less than 100 feet in width between adjacent edges of the driving lanes.

7. Locations for these turnouts shall be based on ease of access, topography as it affects grading costs, easy approach grades, and availability of water supply. Trees and scenic or historical values may suggest consideration of location. Land values should also be a factor.

8. The responsibility for selecting the sites and for developing the necessary plans shall be that of the Landscape Architects. It is recommended that standard plans be prepared for these safety turnouts and rest areas early in the development of the interstate system.

Tourist Appreciation

Registration boxes and a supply of registration forms are placed in a number of roadside parks. Motorists are invited to write their name and address, destination, and number in the party. About one-half of those who register make brief comments, sometimes suggesting improvements that are desirable, but more often expressing appreciation for the various park facilities. Motorists are very generous in their praise and appreciation. Remarks such as:

Triangle Brand Copper Sulphate

HELPS SOLVE YOUR WATER PROBLEMS

Triangle Brand Copper Sulphate economically controls microscopic organisms in water supply systems. These organisms can be eliminated by treatment of copper sulphate to the surface. Triangle Brand Copper Sulphate is made in large and small crystals for the water treatment field.

Roots and fungus growths in sewage systems are controlled with copper sulphate when added to sewage water without affecting surface trees.

Booklets covering the subject of control of microscopic organisms and root and fungus control will be sent upon request.



**PHILIPS DODGE
REFINING CORPORATION**
300 Park Avenue, New York 22, N.Y.
5310 W. Sixty-sixth St., Chicago 38, Ill.



NEW HUSTLE FOR '58 . . . CHEVROLET LIGHT- AND MEDIUM-DUTY HAULERS



More horsepower . . . more staying power in V8's and 6's!

New Chevrolet light-duty Apache and medium-duty Viking models bring you V8's and 6's that deliver more horsepower, more economical and dependable hauling for the toughest jobs you've got!

There's new standard power in every light-duty model . . . a more powerful (145 h.p.!) edition of the engine most famous for economy and dependability, the rugged Thriftmaster 6. And the optional (extra-cost) Trademaster V8 is *all new*, the most highly powered light-duty truck engine in Chevrolet history! It's ready to go to

work with 160 h.p., 283 cubic inches of displacement, short-stroke efficiency and weight-saving compactness!

Chevy for '58 is here with new medium-duty power, too! Standard in Series 50 L.C.F. models is a new version of the Heavy-Duty Taskmaster V8, with 160 h.p. for fleet hauling and new durability features such as Stellite-faced exhaust valves and induction-hardened exhaust valve seats. And standard in Series 60 models is the time-proved Jobmaster 6 with more power than ever—150 h.p.—and a host of new features that mean more economy and dependability on jobs that work a truck hard. See your Chevrolet dealer and *save* with Chevy's new brand of hustle! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

Latest editions of the "Big Wheel" in trucks

NEW CHEVROLET TASK-FORCE 58 TRUCKS



"Thank you for a nice, clean park"; or "It is a pleasure to visit in a State that has parks like Kansas"; or; "We enjoyed our lunch in this nice park", are typical. Other comments are more brief, such as: "Thank you", "Nice Clean Park", "Tables are clean". "Lovely shade", "Good cool water", "Beautiful country and good roads", etc.

Motorists who plan to visit in Kansas or who may be passing through this State from east to west, north to south, or vice-versa, are most cordially invited to motor safely on our good highways and to enjoy our roadside parks.

Available for Local Erection

Earp-Thomas Continuous Flow Compost Digester

The Earp-Thomas Continuous Flow Compost Digester, with a 50-ton per day capacity, can now be supplied knocked down at Houston, Texas. Estimated shipping weight is 87,500 pounds.

The 50-ton per day capacity refers to the approximate amount of digester intake over a 24-hour period. The approximate output of high grade compost is two-thirds to three-quarters of this amount; the weight loss being due to moisture

evaporation resultant of high temperatures created by oxidizing bacteria during the process. The addition of rock phosphate, vitamins, hormones, trace minerals and secondary nitrogen-fixing bacteria in order to make a reinforced superior organic fertilizer, will bring the weight of daily output back to approximately 50 tons.

Local erection of the knocked-down digester is recommended since savings in labor costs can often be effected; but if necessary a trained engineering and erection crew can be sent to do the job.

Additional equipment includes the following: A building to house equipment, approximately 70 feet x 45 feet. This is not absolutely necessary, but it is preferable to house the digester rather than have it constantly exposed to the elements.

Storage bins are usually erected for the storage of the raw material as it is trucked in just prior to grinding and conveying to the digester. Size and construction are dependent on the nature of raw material and local needs.

A grinding hog is used to reduce raw organic matter to small particles, and also to add homogeneity to the mixture. The cost is \$5000 to grind 6 tons per hour and \$8000 to grind 12 tons per hour; the unit should have molybdenum steel blades.

A conveyor is not necessary if local conditions allow for the digester erection on the side of a hill, or if design of building makes gravity feed possible.

An inoculating machine may be used to dispense bacteria over raw organic matter as it passes up conveyor to top of digester. This can be eliminated if bacteria are mixed in while the material is being ground, though this often necessitates added labor cost.

Finished grinding equipment dispenses the rock phosphate, vitamins, hormones, trace minerals and secondary nitrogen-fixing bacteria to make finished reinforced organic fertilizer to the bagging.

• • •

Municipal Mosquito Control

An annual mosquito control campaign is carried on by Pritchard, Ala., which costs about \$5,000 per year. As a result, mosquitoes have been practically eliminated from the area, with resulting comfort to the residents.

here's all
the equipment
you need
to
sanitize
with
HTH



The convenience and the quick, positive chlorine action of HTH Granular make it ideal for water sanitizing at all points from source to faucet. And HTH effectiveness is matched by its economy.

Dry, non-dusty, easy to store and use . . . HTH offers 70% available chlorine for sure elimination of bacteria, algae, fungi and odors from reservoirs, wells, mains, spray ponds, filters and other danger spots.

Call your supply house today. Or write Olin Mathieson directly. You'll be surprised how many water treatment problems you can solve with HTH Granular.



HTH Granular is available in 100 lb. drums and cases of nine 5 lb. cans.

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HTH

OLIN MATHIESON CHEMICAL CORPORATION
INDUSTRIAL CHEMICALS DIVISION • BALTIMORE 3, MD.

4263



● SPRAYER designed by the Connecticut State Highway Department for applying weed killer under highway guard rails.



● GUARD RAIL area which has been treated with soil sterilant plus bitumen. Photo was made two years after treatment.

Weed Control for Roadside Drainage

WILLIAM I. BOYD,

Technical Representative,
E. I. du Pont de Nemours & Co., Inc.

WHILE CONTROL of vegetation is part of highway landscaping to meet the public demand for well-groomed right-of-ways, it is also an important part of safe and efficient highway operation and maintenance. Many state and county highway departments have turned to chemical weed control. One class of chemicals is used for selective control of broad-leaved weeds in grass covered roadsides. A second class is used for complete control, where it is desirable to keep ground free of vegetation for an entire season or longer. The latter may be used to keep extensive areas free of vegetation, especially where there is a drainage problem; or they may be used as an aid in making mowing operations more efficient—in the interest of safety, economy, and roadside appearance. Connecticut state officials have determined that they can reduce some items of their roadside maintenance costs by 80 percent with a program using this type of chemical. Where vegetation interferes with road shoulder drainage under guard rails, the Connecticut State Highway Department has tackled the problem with two programs—one for established highways and the other for new construction.

On established highways, the Department has found that grass and

weeds under guard rails trap enough sand so that a berm gradually forms, resulting in an impediment to roadway drainage. Hand-mowing or hand-grubbing along the guard rails is both expensive and hazardous for the workmen, and no mechanical scraper has been found that will do a neat and effective job of "scalping" along guard rails. With about 2,000 miles of guard rail along the state highways, this has become a major maintenance problem.

The Connecticut State Highway Department began experimenting with chemical herbicide treatments in 1952, and in 1954 set up one-acre tests (two feet by four miles) in each of the state's four highway districts. As a result of these tests, the following procedure was established for existing highways: The vegetation is first killed off with appropriate chemicals to reduce the bulk to be removed when the berm is leveled. Then the earth berm is scraped off.

Following removal of the berm, the soil under the railings is treated with "Telvar" DW weed killer, and a light surface treatment of tar is applied to stabilize the soil surface. This treatment is designed to last up to five years before any re-treatment is needed, and it takes the place of numerous men working with grub hoes, who still couldn't keep up with the job.

On new construction, the soil under guard rails is smoothed, treated with "Telvar" DW and tarred from the outset. The same treat-

ment is also being used where a structural berm is installed for controlled drainage.

Generally the treated area along Connecticut guard rails is about two feet wide, and ten pounds of "Telvar" will treat a mile of guard rail at this width. The cost per mile for the "Telvar" is approximately \$39 and the complete job is \$146, which comes to less than \$30 per mile when budgeted over a five year period. In contrast, hand-mowing under guard rails costs \$50 per mile and should be done three times a season. So the new Connecticut program gives five years control for the price of one year under the old method. The \$146 breaks down as follows: In the initial clearance the material cost \$5 and the application of it cost \$2; the "Telvar" DW weed killer cost \$36, plus \$3 for applying it; the bitumen (RT 4 at 0.4 gal. psy) cost \$95 and the application was \$5.

As with all herbicides, certain precautions are necessary in the use of these weed killers to prevent damage to desirable plants. Special care should be taken to avoid spraying on or near desirable trees, turf or other plants; or in locations where the chemical may be washed or moved into contact with their roots.

Used properly, with adequate precautions, chemical weed killers are a valuable tool in highway maintenance providing substantial economy, and improved highway safety.



PUBLIC WORKS DIGESTS

Prepared by
FRANK FORCE
Associate Editor

THE HIGHWAY AND AIRPORT DIGEST

Example of Surcharge To Speed Fill Settlement

A deep silt substratum beneath a 280 x 1300-foot fill area for a toll plaza for Baltimore's Harbor Tunnel was revealed in the final design borings. This silt body was 60 ft. in depth and it was subject to settlement under load. The proposed 30-ft. fill would satisfactorily consolidate the silt in 13 months, but the construction schedule permitted about 6. It was decided to accelerate consolidation by means of an earth surcharge. The soils engineer determined that a 20-ft. surcharge could do the job in just over 5 months. On the toll plaza fill proper the side slopes of the additional fill were set at 1:1 with the toe of slope coincident with the shoulder of the permanent fill. As construction had progressed upwards, 4-ft. lengths of 2-in. steel access pipe were added finally to protrude above the completed fill. Through the consolidation period, settlement of these plates was recorded twice each week by precise level readings. Near the end of the predicted 6-month limit the plotted settlement curves leveled off and the area was shown to be satisfactorily consolidated.

"An Example of Surcharge Application to Speed Fill Settlement." By William F. Hallstead, Whitman, Requardt and Associates, Consulting Engineers, Baltimore, Md. *Roads and Streets*, October, 1957.

Control Roadside Park Insects

The trouble caused by insects at roadside parks could be reduced considerably by the use of proper control methods. Flies can be controlled by scattering poison baits in and around garbage receptacles and latrines and under picnic tables. Most of these baits consist of a mixture of sugar, cornmeal, crushed shell, or other inert substance, and one to two percent of an organic phosphorous insecticide. Chiggers can be controlled for a month or more by applying chlordane or toxaphene at 2 to 2½ pounds, or lindane at ¼

to ½ pound, per acre in a spray or dust. Ticks and ants may be controlled for several weeks by applying sprays of DDT, chlordane, toxaphene, or dieldrin at 1 to 2 pounds per acre, or lindane at 1/10 to 1/5 pound per acre. Road maintenance personnel can destroy wasp colonies by applying a chlordane spray or dust to the nests. Spraying of ground litter and vegetation up to about 5 ft. in recreational areas, as well as latrines, shelters and under tables, with DDT at 2 to 4 lbs. per acre will do much to reduce the annoyance of mosquitoes and biting gnats. Cracks and crevices under the tops of picnic tables may be sprayed with 2 percent chlordane and 0.5 percent lindane to control scorpions and centipedes. To control black widow spiders, spray the underside of seats in latrines with 5 percent DDT.

"Control Those Roadside Park Insects." By A. W. Lindquist, Entomology Research Div., Agricultural Research Service, U. S. Dept. of Agriculture. *American Road Builder*, October, 1957.

Subdivision Homes Can Create Problems

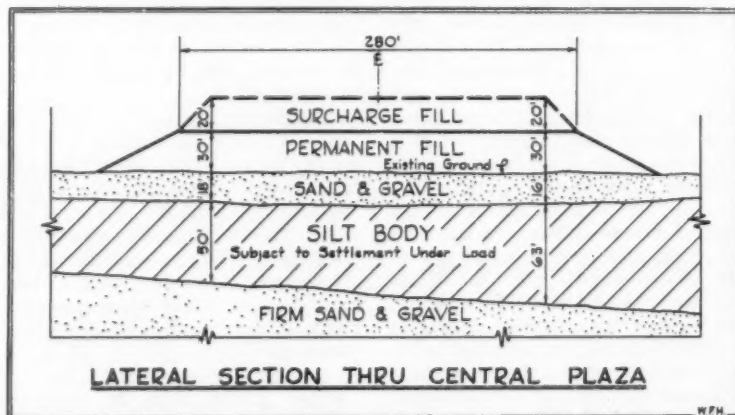
It has been attempted to outline the steps in developing a subdivision in Contra Costa County, California, unincorporated areas, pointing out highlights of basic laws, the con-

trolling local ordinance and pertinent policies from the engineers' point of view. Many counties, with subdivision problems, may not have separate organizational units, such as the Traffic, Materials and Testing, Location, and Construction Divisions, which are set up in Contra Costa's Public Works Department. However, the functions performed by these Divisions in the complicated subdivision process must be taken care of in accordance with the needs of local areas. One man may do the whole job in one jurisdiction; several may be too few in another. The subdivision process outlined in this article will be of interest to public engineering organizations that work with this field.

"Subdivision Homes Can Create Problems." By Victor W. Sauer, Director of Public Works, Contra Costa County, California. *PUBLIC WORKS*, November 1957.

Better Signing With Sign Logs

In the sign log used by the Virginia Department of Highways, the first column gives the section number, as all cost accounting is done by IBM machines and all labor, material and equipment charges must be to route and section. The second column is the mile post, by hundredths from the county line or



● EXAMPLE of surcharge application to expedite the settlement of highway fills.

After an Idaho winter's test, a street superintendent says:
**"THE CATERPILLAR NO. 12 MOTOR GRADER
IS THE BEST MACHINE MADE"**



Repairing winter damage to the streets of Boise, Idaho (population: 35,000), is the continuing assignment of this Caterpillar No. 12 Motor Grader. Now it's in its second blustery season on the job. Boise Street Superintendent Jim C. White comments: "We've run it eight and nine hours a day, six days a week, with no down time. I think it's the best machine made."

For snow removal, the No. 12 has a full line of hydraulic attachments: snow plow, snow wing, bulldozer, steering booster and moldboard shift. And Domor Snow Blowers and Elevating Graders are easily attached.

The No. 12 offers the exclusive new Preco Automatic Blade Control which makes it possible to control slopes within $\frac{1}{8}$ " in 10' width. Other new improvements also help keep the No. 12 the standard of the industry. Redesigned front axle components give extra strength and longer life; an adjustable seat and a taller cab with better ventilation and 31% more window area increase operator efficiency; longer frame and tandem assure full utilization of No. 12's versatility—including use of 14.00-24 tires with chains.

About the long-life oil clutch White says, "We have to ride the clutch a lot—going over manholes and the like—but we've never had to adjust it." Other important features include a dependable CAT® Diesel Engine, a long radius, curved side shift rack that allows a full range of blade positions without changing links or adjusting the blade, and tubeless tires which reduce tire down time as much as 80%.

With the No. 12 at your command, you're ready for winter's assault. Let your Caterpillar Dealer show you how a No. 12 can save money for your municipality the year around. His complete parts and service facilities stand behind your investment, too.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

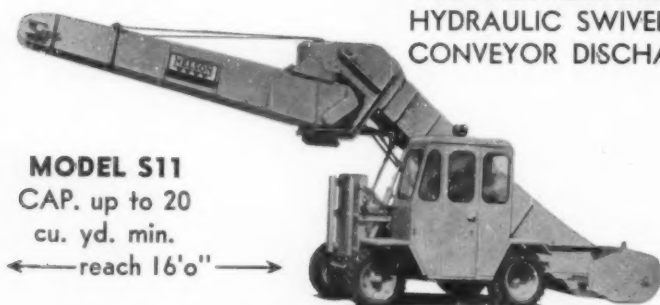
*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

**YOUR TAXPAYERS GET THEIR
MONEY'S WORTH WITH
CAT-BUILT MOTOR GRADERS**



"OVER-CAB" SNOW LOADER

WITH ALL ALUMINUM
HYDRAULIC SWIVEL
CONVEYOR DISCHARGE



MODEL S11
CAP. up to 20
cu. yd. min.
← reach 16'0" →

Permits single or double lane loading with trucks traveling either direction. The 16 ft. conveyor fully hydraulically operated, swings thru 90° circle for spot loading. For the most modern in snow removal methods get full facts on the Nelson S-11.

Write for Descriptive Literature



N. P. Nelson Iron Works, Inc.

852 BLOOMFIELD AVE., CLIFTON, NEW JERSEY

Getting TRAFFIC-SAFE Pavements is your basic Winter-Time problem.

You can get those Traffic-Safe driving conditions Faster and Cheaper if you use the "Scotchman" Method of Ice and Snow Control . . . spread de-icing salts Early, Thin and Wide.

You can salt-treat your pavements 8 times Faster and 50% Cheaper with a stainless steel "Scotchman". Choice of 3 models to use on any dump truck or pick-up . . . no complicated hook-ups. One man Cab Control is optional.

EXCLUSIVE features: 1. Cartridge-type Power Unit . . . engine, impeller and electric starter in a single, compact unit—removed or installed in 5 minutes; 2. Accurate Controls . . . of rate of spread, of direction and width of spread; 3. Stainless Steel . . . all sheet metal touched by salt. For details and demonstration see your "Scotchman" dealer or write to us.



Nothing Saves Like a "Scotchman"

TARRANT Manufacturing Company

28 Jumel Place, Saratoga Springs, N. Y.

corporate limit where the log is started. Column 3 is a description of the sign and column 4 the code number. Column 5, size, is generally used only when the sign is not of standard size since the code number of standard signs also gives the dimensions. Column 6 tells the side of the road, right or left in the direction of travel and column 7 the compass direction that it faces. Column 8 shows the condition of the sign and column 9 tells what route symbol is on the back of the sign. In column 10 is listed the date of the original installation of the sign and in 11 the date of replacement. Comments are written in column 12. In city sign work, a physical reference to a sign location is easier to use than a mile post. On this log column 1 is a location number used for reference; column 2 is a description of the location; and column 3 the code number of the sign in place at the time of inspection. Column 4 is a space in which to list the signs needed to supplement or replace a sign or make a comment.

"Better Signing With Sign Logs." By R. W. Wallace, Highway District Traffic Engineer, Virginia Dept. of Highways. PUBLIC WORKS, November, 1957.

Subsurface Exploration For Highway Construction

A soils engineering service may generally be outlined in the four following steps: Exploratory borings and samplings; determining engineering properties; analyzing information obtained; and designing soils engineering works. The three types of soil borings that are usually called for in highway construction are soil profile borings, deep cut borings and structure borings. The following factors should be considered in determining what the average daily footage for a given machine may be: Variability of topography; availability of water; number of fences that must be crossed; attitude of farmers and local townspeople; and general knowledge of material to be drilled. The above mentioned factors should be used when the contractor is bidding in open competition for a job. In figuring the cost of operation, all of the following factors should be considered: Probable crop damages; labor; local wage scale and living allowance; labor union, both internal and local; and equipment maintenance costs.

"Subsurface Exploration For Highway Construction." By John N.



This heavily traveled U.S. highway has to stay open during the winter, no matter what the weather conditions! That's why straight Sterling Rock Salt is used for snow and ice control.

Straight Sterling Rock Salt Keeps This Road Open at Low Temperatures!

20° . . . 12° . . . 0°. Even at these temperatures, your roads can be clean and safe during winter storms. Straight Sterling Rock Salt will do the job!

Cities and highway departments across the nation's ice belt confirm this fact: Straight Sterling Rock Salt has effective melting power at temperatures ranging from 32° F. all the way down to below zero! It can be used for ice and snow control in any area—no matter how severe the weather. All that's necessary is to increase the amount of salt used at low temperatures—just as it's necessary to use more fuel to heat your home when it gets colder outside.

For example, many communities today use about one-third more Sterling Rock Salt when the temperature falls below 20°. And this provides a bare, safe pavement! By the same token, it's also possible to get bare-pavement safety on steep grades. Just use *more* Sterling Rock Salt as the grade increases.

How Sterling Rock Salt works. It helps turn snow into slush—quickly. And when ice forms, the salt crystals (with exclusive "Auger-Action") bore through the ice layer to the road surface. Here, brine is formed, breaking

the bond between ice and pavement! In contrast, abrasives just can't do this job! They have no melting power . . . cannot provide the bare pavements so vital to traffic safety.

Finally, consider the economies of straight Sterling Rock Salt. This material has a low delivered cost . . . covers more road mileage than abrasives or salt-and-abrasive mixes . . . and dissolves with the snow and ice it melts. It leaves no time-consuming, costly clean-up jobs!

REMINDER: You can protect rock salt from caking in storage with new Sterling Storite. This remarkable chemical keeps salt free-flowing, ready for immediate use. Send for free booklet giving full details.

International Salt Co., Inc.

SALES OFFICES: Atlanta, Ga.; Chicago, Ill.; New Orleans, La.; Baltimore, Md.; Boston, Mass.; Detroit, Mich.; St. Louis, Mo.; Newark, N. J.; Buffalo, N. Y.; New York, N. Y.; Cincinnati, O.; Cleveland, O.; Philadelphia, Pa.; Pittsburgh, Pa.; Memphis, Tenn.; and Richmond, Va.



STERLING "AUGER-ACTION" ROCK SALT

INTERNATIONAL SALT COMPANY, INC., SCRANTON, PA.

Kilman, Gerald D. Mann, MSCE, BME, Mobile Drilling & Engineering, Inc., Indianapolis, Ind. *Modern Highways*, October 15, 1957.

Soil-Cement Street In Eastern Washington

Clarkston, Washington, completed a 1300-ft. section of soil cement paving with the abutting property owners selecting this type of paving. It cost \$1.26 psy to construct the pavement, which included the 6-in. soil cement base and two seal coats. The curb and gutter cost \$1.30 per lineal foot. The roadway is 31 ft. wide and the paving was done in 2 days. A

motor patrol was used to bring the material to grade and a Pulvi-Mixer to mix the cement, water and road material. Sacked cement was used with an 8.5 to 9.0 percent cement content used. A rubber-tired roller towed by a Jeep made the first compaction pass and loaded dump trucks were used for further compaction. Fine grading was done by the patrol and final compaction by an 8 to 10-ton steel wheeled roller. Two days after completing the job, a seal coat consisting of MC-3 asphalt covered with $\frac{3}{8}$ -in. to No. 10 chips was applied. The second seal, applied a week later, also consisted of MC-3

asphalt, but sand was used in place of chips.

"Clarkston Constructs First Soil-Cement Street in Eastern Washington." By Eugene W. Asselstine, City Engineer, Clarkston, Wash. *The American City*, October, 1957.

Snow-Fighting Experiences of Several Highway Departments

Five different highway departments describe their snow removal operations. Their operations are briefly covered below: On the Pennsylvania Turnpike snow clearing involves one-fourth of the maintenance cost. In the field, the maintenance organization is divided into 5 districts or divisions spaced about 100 miles apart; In Washington, D. C., "Operation antifreeze" is the sanitation department's snow removal program and is carried out by approximately 3,000 men using snow plows, trucks, sand and salt; Albany County, New York, has 511 miles of county and state highways to maintain for safe winter driving. The county spent \$460,500 for snow and ice control last year and has stockpiled 1050 tons of salt, 8300 tons of sand and 10 tons of calcium chloride for this coming season; Chief Engineer August E. Zentgraf of Newark, N. J., uses rock salt for all ice conditions and snow storms up to 5 or 6 inches in depth provided the temperature is above 20° F. Approximately 1500 tons of bagged rock salt is used each year, of which 600 tons is stored at one time; the state of Delaware has made great use of their 2-way radio systems in fighting snow. Roads in the state are plowed when a fall of snow reaches a depth of 1-in. and the state has 130 pieces of equipment available to fight the storms.

"The Snow Story." *Constructioner*, September 30, 1957.

Studies Show Pulvi-Mixer Has Lowest Mixing Cost for Base and Sub-base Stabilization

Cost surveys covering in-place mixing for city streets and county highways show substantial savings where the Seaman-Andwall PULVI-MIXER is used. In the cost reports, in general, asphalt and soil-cement construction but in a number of instances, superior sub-base stabilization laying a high type street or highway.

The costs relate to operations only and do not include subsequent operations compaction, seal-coating and course application.

Airport runway construction also included in several cases, especially in building aprons, parking areas and taxi-ways.

Not included are the cost of the basic construction materials.

These of course vary with the engineers specifications. Studied, however, were the labor cost, materials, and the mix and the yards of

*Get a
Seaman-Andwall
Pulvi-Mixer
in our '58 Budget*

all PULVI-MIXER has completed an average of 100 yards of compacted material per day. This is a great saving in labor and time. The PULVI-MIXER is a compact, portable machine that can be used in a variety of applications. It is ideal for mixing soil-cement, soil-asphalt, and other materials. The PULVI-MIXER is a must for any contractor who wants to save money and time on his next project.



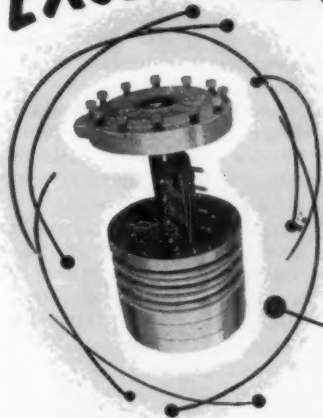
Seaman Pulvi-Mixer (TRAV-L-PLANT Model) mixing soil-cement base on city street construction.

Dept. R-227

Stability of Asphaltic Paving Mixtures

On the basis of the analysis of stability presented, together with supporting test data and other evidence cited in this article, it is concluded: 1) The most important aggregate characteristic insofar as the stability of an asphaltic paving mixture is concerned is the surface roughness of the aggregate particles, with size and shape of considerably less importance than generally believed; and, 2) the only reliable methods of evaluating the strength characteristics of a granular material is through the use of a triaxial compression test, particularly for aggregate combinations

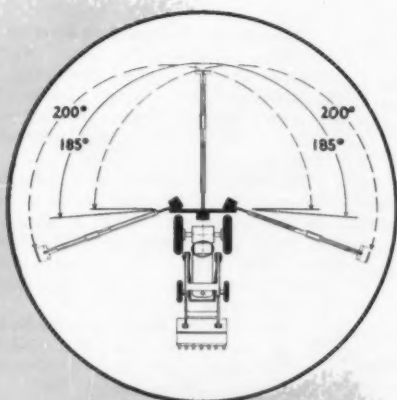
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This diagram illustrates the degrees of continuous operating arc from each of the three mounting locations — 200° when side mounted, or 185° center mounted. Has no pins to change or cable to break

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POOL AND DRESSING ROOM EQUIPMENT

with particles of varying surface roughness characteristics.

"The Stability of Asphaltic Paving Mixtures." *Highways and Bridges and Engineering Works*. September 18, 1957.

Rock Salt For Snow and Ice Removal

A generally accepted initial rate of application of rock salt in New York City for sleet and ice storms is about 0.125 lb. psy; and that for snow storms is about 0.25 lb. psy. The annual needs of salt for the city are about 80,000 tons—60,000 tons for average anticipated weather conditions plus 20,000 tons in reserve for unforeseeable emergencies. The program for salt storage was developed to take advantage of bulk shipments and portable crane unloading into dock side, silo type tanks for primary storage. The tank construction permits gravity discharges into transfer trucks and salt spreaders. Secondary storage for servicing tributary areas is to be provided in nine sheds having light steel superstructures resting on a combination retaining wall and footing. The sheds have an 80-ft. span, clear height at center of 26 ft. and lengths of 100, 150 and 250 ft. to store from 4200 to 9500 tons each. The cost of the program is estimated at about \$10 per ton or 35¢ per cubic foot of salt volume. The basic solution in stopping caking lies in coating the salt particles with either an insulating or a moisture absorbing film. Tests were run on different admixtures and it was found that silica gel gave the most consistent and dependable results. To protect old concrete from damage, covering exposed surfaces with a protective sealing agent is practical; for new concrete, use air entrained cements. There have been tests run on the effects of salt on steel, but the results have been inconclusive.

"Rock Salt for Snow and Ice Removal." By C. A. Rogus, Director of Engineering, Department of Sanitation, New York City. *PUBLIC WORKS*, November, 1957.

Public Transit and the Utilization of Streets

In this study, a comparison is made of the relative efficiencies of public transit vehicles and private automobiles in utilizing street space and transporting people. The operation of buses, street cars and automobiles was investigated in Washington, D. C., and trolley coaches and automobiles in Atlanta, Ga. The results of the study show that buses

operating in Washington, D. C., were 3.7 times as efficient as automobiles on downtown streets, 4.6 times as efficient in intermediate areas, and 2.6 times as efficient in outlying areas. Street car versus automobile operation was observed in the downtown area of Washington only, and it was found that streetcars were 1.8 times as efficient as automobiles. Trolley coaches in Atlanta were found to be 6.3 times as efficient as automobiles on downtown streets, 8.7 times as efficient in intermediate areas, and 6.3 times as efficient in outlying areas. A comparison of bus and automobile operation on the Atlanta Expressway indicated that buses were 7.2 times as efficient as automobiles.

"The Efficiency of Public Transit Operation in the Utilization of City Streets." By William P. Walker, Highway Transport Research Engineer, and Roy A. Flynt, Georgia State Highway Planning Engineer. *Public Roads*, October, 1957.

Other Articles

"Two-Way Radio in County Highway Work." By Marion Wilkins, Engineer, Conecuh Co., Ala. *Public Works*, November, 1957.

"Worn-Out Road Rebuilt With Lime Stabilization." Road material and lime were mixed to provide stabilized streets. *Public Works*, November, 1957.

"Suitability, Performance and Economy of Street Lights." By H. Hewitt, AMIEE, FIES, and R. Stevens, BSc, MSIA. *Contractors Record and Municipal Engineering*, September 18, 1957.

"The Work of the Road Research Laboratory in Safety and Traffic." *Roads and Road Construction*, September, 1957.

"Trends in Bridge Construction On Ontario Highways." How Various Types Meet Specific Problems. By Lawrence Loch, Bridge Design Engineer, Ontario Dept. of Highways. *Roads and Engineering Construction*, September, 1957.

"Prestressed Bridge: A 120-ft. Span Erected Daily." Prefabrication of reinforcing cages and in-place fabrication of prestressed beams speeds construction of a 1477-ft. long highway bridge over Connecticut River. *Engineering News-Record*, October 3, 1957.

"Maintaining County Borough Roads." By J. Bamber, M. Inst. W.H.S., A.R.S. H. *Contractors Record and Municipal Engineering*, September 4, 1957.

"Huge Study Seeks Answers to Transportation Problems." Chicago area transportation study is the largest project of its kind ever attempted. Study, costing approximately \$2,350,000, will be completed in 1958, and is expected to result in logical plan for moving people and goods with minimum of friction in an area of 1,400 square miles. *Better Roads*, October, 1957.

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HOW TO USE LANTERNS EFFECTIVELY

for HIGHWAY WARNING and for LIGHTING BARRICADES

KEROSENE LANTERNS are used more than any other warning light for marking barricades, detours and construction sites, yet there is a general lack of knowledge on how many lanterns to use in a specific situation. In addition, many lantern users do not know that the life and effectiveness of a lantern can be increased by as much as 50 percent with a few simple rules of maintenance.

Engineers for the R. E. Dietz Co., Syracuse, N. Y., manufacturers of lanterns and other highway warning equipment, points out that lanterns often have a dual purpose in lighting highway hazards, the marking of barricades or excavations, and illumination of warning signs. Red globe lanterns are most suitable for marking hazards; clear globe lanterns should be used to illuminate signs.

One of the first items to remember in lighting up barricades is that hazard lighting should be placed before twilight. National Safety Council figures show that the highest number of accidents occur between 4 and 8 pm.

Groups such as the AASHO and the National Safety Council recommend that lanterns be not over 8 ft. apart when placed transversely across a traffic lane, and not over 25 ft. apart when marking hazard of longitudinal character, such as an open excavation.

The lanterns can be set on top of a barrel, hung on the barricade by the bail, or set on the ground. In an area of high speed traffic, however, it is generally recommended that lanterns be up off the ground so they can be seen more quickly.

Lighting Up Warning Signs

"Detour" and other warning signs should be illuminated at night so as to be visible from all distances up to 350 ft., according to insurance company recommendations. In such a case, the lantern should be placed on a barrel or hung to one side or below the sign so the light will shine onto the sign. A kerosene lantern provides dependable illumina-



● WARNING and lighting for a construction area parallel to a street. Lanterns are used with flashers and torches to locate the barricades and light torn-up area.

tion for this type of situation, but a highway torch can be used also.

Here are recommended distances for placement of signs in advance of construction or other hazards:

On high speed highways or on curving roads, a series of warning signs should be placed ahead of the hazard. The first of these should be about 1,500 feet in advance, with the other at 1,000 and 500 feet. A final warning sign such as "One Lane Traffic" or "Pavement Narrows" should be in place 200 feet in advance of the obstruction. Two clear globe lanterns hung on the corners of the signs will call attention to them as well as provide illumination. Where a barricade is used to force traffic into a detour, lanterns should be strung across the front, spaced no more than 8 feet apart. Show the extremities of the barricade by placing a lantern at each end. In a hazardous location of this type, the lanterns are also immediately available for any emergency where a portable light is needed.

At night a flagman should use a red light, such as a lantern, instead of a flag. To stop traffic, wave the light back and forth across the path of the approaching vehicle until it has been stopped. Do not use light as a signal to proceed. Use hand or give verbal orders for vehicles to

proceed. The flagging station should be effectively lighted and barricaded.

Maintenance of Lanterns

Although easy to operate, there are several features about a kerosene lantern that many people do not know. Simple rules of maintenance can often double the life and effectiveness of a lantern. Here are tips that will provide more effective lighting from lanterns.

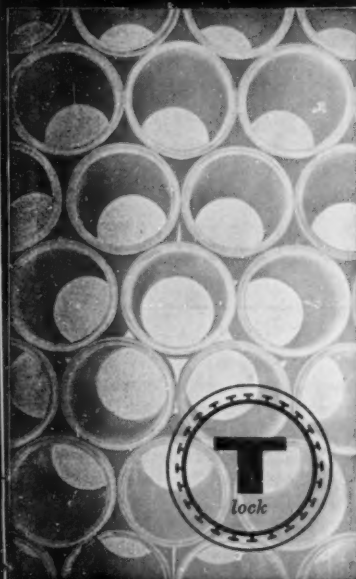
Trim wick (either charred portion of old wick or fuzzy portion of a new one) by cutting it straight across. A straight wick will burn more evenly, give better light.

Keep lantern level when it is burning so the flame does not burn on one side of the globe more than the other and cause a smoked globe.

Set the flame low when first lighting a lantern. The flame will burn higher after the lantern reaches operating temperature.

Let globe down easy after the lantern is lighted. Do not return globe to normal position with a bang. If not properly seated, it may allow the wind to put out the flame.

Keep in mind that dependable, steady light at construction sites or other hazards will be a great help in preventing accidents—and lawsuits.



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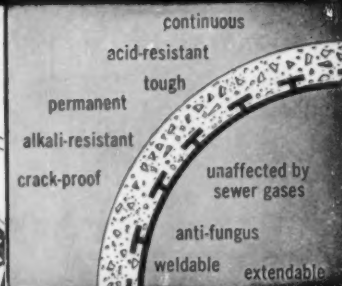
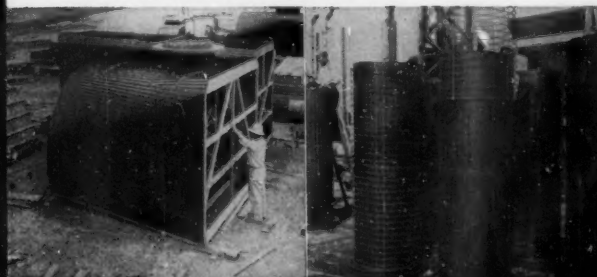
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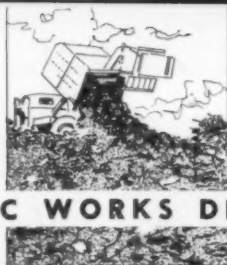
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PUBLIC WORKS DIGESTS

Prepared by

ALVIN R. JACOBSON, Ph.D.

Associate Professor and Head,

Division of Sanitary Science,

Columbia University School of Public Health

THE SEWERAGE AND REFUSE DIGEST

Vacuum Filtration of Raw Sludge

Recently the city of Belton, Mo., population 3,010, completed construction of an activated sludge plant without facilities for sludge digestion. Economic considerations dictated that the sewage treatment plant be built as economically as possible. It was decided that dewatering of the raw sludge on a coil-type vacuum filter be substituted for conventional sludge digestion. The plant facilities consist of grit removal, primary sedimentation, aeration, final clarification, and sludge dewatering. Design capacity is based on an ultimate population of 4,000 and a sewage flow of 100 gpd, entirely by gravity. Chemical treatment and vacuum filtration eliminate the need for digestion and sludge drying beds. The State Department of Health requires burial of the dewatered sludge at present; however, tests are in progress to determine if chemical treatment of the sludge during the vacuum filtration destroys the pathogenic bacteria. If the tests are successful, the city can probably reduce the cost of sludge disposal still further.

"Vacuum Filter But No Digester."

By R. H. Sorber. *The American City*, October, 1957.

Composting Organic Wastes Profitably

Composting may be accomplished profitably in many communities, the amount of profit depending upon the local circumstances. At the same time there will be a definite conservation of organic matter for a useful purpose. Most communities spend from one to 5 dollars per ton for the disposal of garbage and refuse depending upon the local methods for disposal. The profit that may be realized from the operation of a compost plant should be from \$2 to \$5 per ton of raw material handled. In addition, sewage solids may also be composted along with the garbage and refuse in one operation. In fact, composting may be improved by this combination; a better end product may be

obtained; and the overall economy may likewise be improved. With industry, there may be a wide variety of organic wastes, especially those in the canning, meat packing, paper, lumber and tanning industries that can be disposed of very satisfactorily by composting. The largest stockyard in the world is at present planning to dispose of 140,000 tons of manure from their stockyards each year by composting in order to turn a yearly expense of \$70,000 into a profit. The modern composting process is essentially a fast, efficient aerobic process by which the organic matter is stabilized by bacteria and other microorganisms. This stabilization process consumes large quantities of oxygen and produces considerable amounts of heat, with temperatures between 160° and 170° F. easily maintained, thus insuring the destruction of all pathogenic disease organisms. The three most efficient and economical approaches to composting are 1) by the use of mechanical digestion, 2) use of modified windrows, and 3) bin composting. Six mechanical digesters are presently on the market and three of these are of the continuous-flow type which are described in detail.

Composting is competitive with other methods of organic wastes disposal from an economic standpoint, even if the stabilized material is discarded. The real economy of composting comes from the sale of the end product at a fair price which may be anywhere from \$20 to \$30 per ton, although a small profit may be made at \$5 per ton. This may be done by selling the material in bulk to commercial companies already set up in the fertilizer business.

"Composting Your Organic Wastes at a Profit." John R. Snell. *PUBLIC WORKS*, November, 1957.

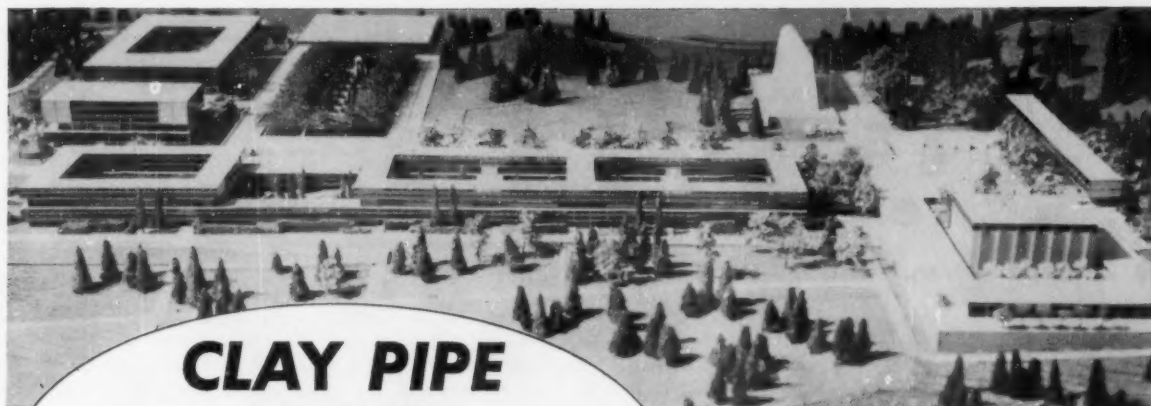
Handling Sewage Solids

Cities of all sizes are finding it more difficult each year to dispose of their sewage solids due to the increasing high land values for suitable disposal areas and to the higher labor costs. More consideration should be given to the problem of determining the most satisfactory and economical method of handling or conveying sludge during the initial stages of plant design, whether the sludge is to be used for fertilizer or is to be incinerated. For handling



Courtesy M-B Corporation

● TWO OF the three essential elements in solving the refuse problem are illustrated in this picture: The water tight can in good condition; the modern packer-type body into which the refuse is being carefully handled. The final step consists of adequate disposal in a modern incinerator or by the sanitary landfill method.



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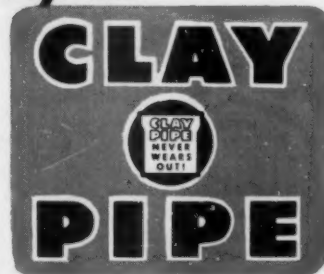
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burned ash from sewage sludge incineration, the hydraulic type of system is preferable when adjacent land is available for final disposal. If storage in a bin adjacent to the plant is desired, mechanical handling appears to be most foolproof at the present time. When handling dried sludge for use as fertilizer, the pneumatic conveyor for the flash drying system and mechanical handling for the multiple hearth furnace appears to be the best types. Power requirements vary between 1.0 and 3.0 KWH/ton of sewage solids while the capital cost per ton of dry solids burned per day varies

from \$350 per ton for the hydraulic system for a large city to \$1200 per ton for the pneumatic system for a small city.

"Methods of Handling Dried or Incinerated Sewage Solids." By Robert K. Hampton, P.E. *Water and Sewage Works*, October, 1957.

Petersburg's Sewage Treatment Plant

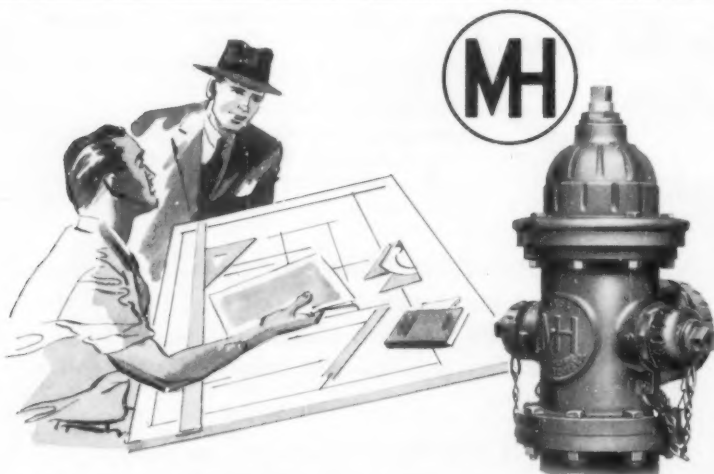
In November, 1956, the city of Petersburg, Va., put into operation a completely new sewage treatment plant with a designed capacity of 7 mgd for an ultimate population of 55,000, although the present popula-

tion is approximately 45,000. Initially, an interceptor was installed along the Appomattox River to which the various sewer outfalls were connected. The sewage is discharged from the interceptor into the main pumping station and passes through a 4-inch bar rack equipped with a mechanical trash rake, then through a 3-inch opening automatic bar screen equipped with a moving chain rake, through a Parshall meter flume and into a wet well. From here the sewage is pumped through a 30-inch cast iron main approximately $\frac{3}{4}$ mile to the treatment plant where prechlorination takes place ahead of the pre-aeration tanks. Following a 30-minute detention in these tanks the sewage flows into two primary rectangular settling tanks having an average detention period of $2\frac{1}{2}$ hours. The raw sludge is transferred to the primary digester where lime may be added for pH control. The sewage effluent from the primary settling tanks spills over skimming weirs where a second dosage of chlorine is added and then into a chlorine contact tank having a detention of 1 hour before final discharge through a cascade into the tidal water of the Appomattox River. The digested sludge from the primary digester is transferred to the secondary digester for an additional period of holding and thickening before being transferred into a conditioning vat where ferric chloride and lime may be added before application onto a 150-square foot vacuum coil filter. The dewatered sludge travels by a conveyor belt to a pug mill mixer where it is pulverized, then it is flash-dried at a temperature in excess of 1000° F. and is ready for storage from where it can be dispensed into a bulk loading or bagging apparatus. The final product is sold and used as an excellent soil conditioner.

"New Sewage Treatment Plant at Petersburg, Va." By T. T. Musgrove. *Water and Sewage Works*, October, 1957.

Improved Sanitation

The city of Johnson City, Tenn., has embarked on a city-wide program of improving its sanitation program as a result of a comprehensive sanitary survey made during the spring and summer of 1954. This study made by the members of the Health Department included sewage disposal, water facilities, garbage and refuse collection and disposal, animal and fowl pens, shelters, screening and rodent infestations. A system of weighted penalty points



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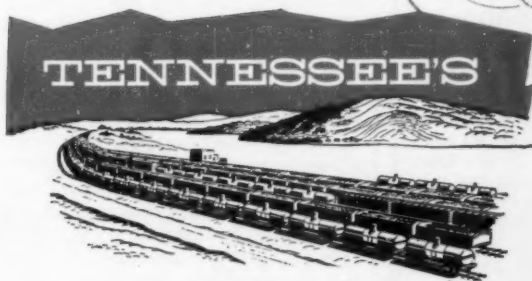
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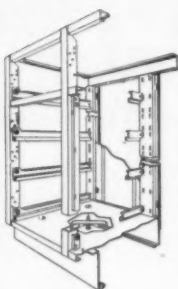


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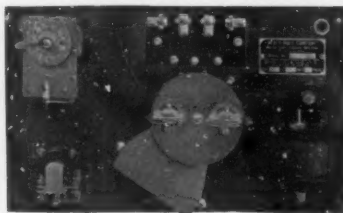
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791 Hampden Ave., St. Paul 4, Minn.

was applied to each infraction of acceptable sanitary standards in order to evaluate numerically the general environmental sanitary level of each city block. From the survey which covered 6,934 premises including 6,107 residences, 142 food handling establishments, and 685 other commercial and industrial establishments, it was found that improper sewage disposal was the major deficiency in the environmental sanitation of the city. The city is making an effort to have the 954 residences served by septic tanks and the 573 residences utilizing pit privies connect to the sewer system. A contract for \$400,000 has been let to extend the sewers to all parts of the city with the exception of one small fringe area within another watershed. The second biggest environmental sanitation problem was the unsanitary handling of garbage and refuse on private premises, the survey showing only 59% of the residences handling refuse in a sanitary manner. The city immediately changed from the slope-embankment type to the trench-type of sanitary fill. New collection equipment helped considerably. Three Gar Wood and two Leach packer-type trucks collect garbage weekly from the residential area, and six days per week from the downtown business area. One open truck is used to collect brush and other refuse not handled by the packer units. Changes are also being made in the pickup practices and in the collection routes to increase efficiency and lower costs.

"Johnson City, Tenn., Intensifies its Sanitation Program." By Wm. V. Ricker. *The American City*, October, 1957.

Other Articles

"Sewage Treatment for a Modern Shopping Center." By Frank R. Burde, P.E. *Public Works*, November, 1957.

"Dual Plants Treat Water and Sewage for a Subdivision." By C. E. Wright. *Public Works*, November, 1957.

"Refuse Composting in India." John M. Henderson. *Public Works*, November, 1957.

"Mesophilic Anaerobic Digestion." Part I. Fundamental Factors of the Process. By L. L. Langford. *Water and Sewage Works*, October, 1957.

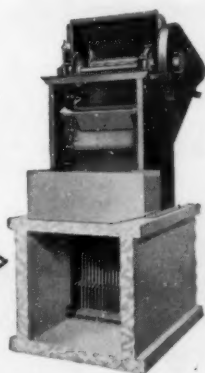
"A Nomograph for the Determination of Concentric Orifice Diameters." By Alexander Goldstein. *Water and Sewage Works*, October, 1957.

"City Plant Serves Villages, Trailers, and University at Low Sewer Charges." By Prof. Philip F. Morgan and Peter F. Roan. *Wastes Engineering*, October, 1957.

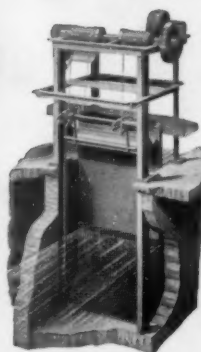
"A 120-Home Subdivision Builds and Finances an Activated Sludge Plant." By L. D. Bishop. *Wastes Engineering*, October, 1957.

Get waste treatment off to a safe start...with LINK-BELT screens

...for removal of large solids



THRU-CLEAN SCREENS. Automatic, chain-operated rakes clean from downstream side, are designed to eliminate jamming by debris. Vertical mounting minimizes friction between rakes and bars.



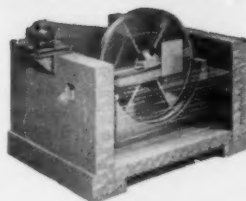
STRAIGHTLINE SCREENS. Automatic, cable-operated rake cleans from upstream side, assures clean, positive screenings removal. Easily accessible—no moving parts are mounted under water.



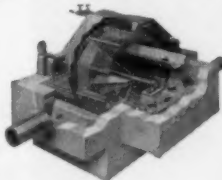
TRITOR SCREENS. Combined screen and grit chamber saves smaller plants the cost of separate units to remove large solids and detritus. Shredder for screenings can be provided, if desired.

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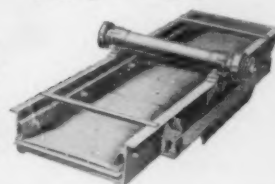
ROTARY DRUM SCREENS. Effectively remove fine solids from large volumes of water. These screens are best suited to installations where a fixed water level can be maintained.



LIQUID VIBRATING SCREENS. For thorough removal of fine solids from industrial liquids. High-energy vibration provides a relatively dry product with minimum blinding or clogging.



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Appeals alike to designing engineers and operators for the treatment of sewage and some industrial wastes where average flow is not over 600,000 gpd.

A combination of Clarifier and Digester, its advantages include: excellent skimming and settling; freedom from offensive odors, unsightliness and foaming; and reasonable cost



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LAKE SIDE ENGINEERING CORP.
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"How Are the States Handling Fringe Area Sewage Problems." A symposium of experiences and opinions of sanitary engineers of state health departments and water pollution control commissions. Wastes Engineering, October, 1957.

"Bottle-Tight Sewers Needed." By Woodrow W. Sherman. The American City, October, 1957.

"Motor Scooter Refuse Collection." The American City, October, 1957.

"Deep Rock Tunnels Under Boston Harbor." The American City, October, 1957.

"343-MGD Deer Island Plant is Part of \$65-Million Construction program." By Martin Cosgrove. Wastes Engineering, October, 1957.

"Detroit Area Adopts a Metropolitan Plan." By Paul M. Reid. The American City, October, 1957.

• • •

HIGH RATE COMPOSTING May Solve Refuse Disposal Problems

DONALD BRENNER,

Design Engineer,

Bogert & Childs, New York, N. Y.

HIGH RATE composting in specially constructed machines may be the answer to refuse disposal problems where other methods have proved impractical or uneconomical. A recent field test of the Depurater, a multiple-stage composter, demonstrated its ability to handle the typical mixture of municipal refuse and garbage arriving at a city incinerator. Detailed measurements and complete analyses of all raw and finished material were made for a period of three weeks.

The raw material was thoroughly ground and mixed before being fed to the Depurater. The actual operating time was eight to nine hours daily, with the plant shut down at night. The average detention time for the raw material in the Depurater was determined by adding plastic chips and noting the time they appeared in the material being discharged. The time was very close to three days, but of this only about 24 hours was actual running time. The material handled varied in character from day to day, with an average composition as follows: Inert (mostly cans and glass), 22 percent by weight; paper, wood, etc., 50 percent; and food wastes, 28 percent.

The general characteristics of the ground and mixed refuse as compared with those of the finished compost were: pH, raw from 4.7 to 6.4, with an average of 5.4 and fin-

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IS SHIPPED



The continued widespread acceptance of the Komline-Sanderson permanent filter media COILFILTER has accelerated manufacturing production rates to the point that a COILFILTER unit leaves the Komline-Sanderson plant at the average rate of once a week.

The 11'-6" x 16' COILFILTER shown above is the first of three 575 sq. ft. units being shipped to Warren, Michigan, for dewatering fresh sludge.



Three large COILFILTER UNITS leaving the plant at Peapack en route to installation at Louisville, Kentucky.

*Write for the new 16 page Bulletin No. 106.
"THE COILFILTER STORY"*

KOMLINE-SANDERSON ENGINEERING CORPORATION
Peapack, New Jersey

MANUFACTURERS OF COILFILTER SLUDGE VACUUM FILTERS

ished, 6.6 to 8.5 with an 8.0 average; moisture, raw from 42.4 to 66.1 percent, average 54.2, and finished from 41.5 to 59.2 percent, average 51.5; volatile, percent dry weight, raw average 72.2 percent, finished 60.6 percent.

The composting resulted in the transformation of material which had a grayish color and a sour greasy odor, typical of raw garbage, to a material dark in color with a slight earthy or moldy odor. The process also resulted in a very high reduction of coliform-type bacteria.

Tests made by mixing samples of the raw and finished materials in distilled water, filtering and then analyzing the filtrates showed that the dissolved solids which would leach out of the finished material were much more stable than those from the raw material. Whereas the total solids were about the same, the BOD of the leachings from the finished material was about one-third of that of the leachings from the raw.

The processed material might be disposed of by landfill methods or might be used as a base for a soil conditioner. Some of the advantages of using the composted material in a landfill as compared to the use of the unprocessed mixture of refuse and garbage are:

- 1) — The handling at the site would be greatly simplified because there would be no problem of wind dispersal of paper and similar material;
- 2) — the material could be consolidated to a greater extent than the unprocessed refuse, resulting in a greater use of the available land;
- 3) — the material being more stable, less settlement of the fill would result;
- 4) — the leachings from the site would be less objectionable from the standpoint of ground water pollution; and
- 5) — there would be no tendency to attract rodents.

Refuse disposal by use of the Depurater, when compared to open-pit composting, showed these advantages:

- 1) — Refuse, after delivery to the plant, is handled in totally enclosed machines and therefore, is not subject to weather conditions; because no refuse is left exposed, rodents cannot become a problem;
- 2) — since the composting is aerobically controlled, no objectionable odor can result;
- 3) — no costly labor is required to turn or remove compost heaps periodically as this is accomplished automatically in the Depurater; and
- 4) — composting in the Depurater entails only about 24 hours to complete its cycle, thereby eliminating the necessity for the

large land areas which are needed where the composting operations involve a processing duration of 15 to 60 days.

The test operation was conducted under the general direction of Dr.

William E. Dobbins, Professor of Sanitary Engineering, and the laboratory analyses under the direction of Dr. Gail P. Edwards, Professor of Sanitary Chemistry, both of New York University.

Selecting Hard Aggregates for Road Building by "Elastic Fractionation"

A NEW PROCESS for removing soft stones from natural gravel deposits has been developed by the Construction Equipment Division of the Blaw-Knox Co. The first commercial plant is now in operation at a pit of the Whittaker and Gooding Co. near Ann Arbor, Michigan.

From the economic standpoint, it is now possible to use locally produced and beneficiated gravels that can be made available at far lower cost than materials shipped in from distant points. Also, elimination or reduction of road deterioration caused by poor quality aggregate will reduce the cost of maintenance and will contribute to highway safety.

The plant developed to process aggregate is relatively simple, consisting primarily of bins, conveyors and elevators, vibratory feeders and impact plates. The process makes use of the fact that soft, deleterious materials have elastic properties widely different from the hard, sound stones. The stones are elevated into an overhead hopper. From this hopper they are gravity-transferred to a vibratory feeder. Stones are delivered from the lip

of the vibratory feeder in a controlled manner so that they drop in the required pattern on to the surface of an inclined plate.

The bounce of the stones depends upon their elastic properties and their shape. Bounced stones are collected in three separate compartments with stones of similar elasticity being dropped into the same bins. The compartments are separated by easily adjustable dividers.

Hard stones have the most bounce. Hence the divider furthest from the impact plate is set at a distance that will be reached by aggregate of the desired composition. The material collecting in the compartment closest to the impact plate will be predominantly soft stones and will be discarded from the stage. Material collecting in the middle compartment will contain some hard and some soft. This portion is automatically and continuously recycled to the feed, to be dropped again on the impact plate.

The net result of the operation of the first stage is the production of beneficiated product and a discard. The discard from the first stage still contains too large a percentage of hard stones to be rejected. To recover the larger part of the sound hard stones, the first stage discard is fed to a second and smaller separating stage. The operation of the second stage is analogous to the first.

Elastic fractionation is applied to well-washed, naturally occurring pebbles graded from No. 4 up to a maximum of 2½ to 3 in. The pit run or dredged material should be washed and screened in the conventional manner. The product is screened and lightly washed to produce beneficiated aggregates of the required size grading.

Nearly all of the 3069 counties in the U. S. have gravel deposits. Of the total sand, gravel and crushed stone produced in this country 60 to 65 percent is used in road construction. It is estimated that the expanded highway construction program will require a billion tons of aggregate annually.



● VIEW of the gravel beneficiation plant near Ann Arbor. Hard and soft aggregates are separated by the plant.



● PAVER lays a course of asphaltic concrete hot mix over welded wire fabric.

Parkway Bridge Gets New Reinforced Asphalt Surface

THE HOUSATONIC River Bridge, joining the Merritt Parkway to Wilbur Cross Parkway in Connecticut, has been resurfaced with specially designed deck combination of heavy steel "bleeder" plates, capped with welded wire fabric-reinforced asphaltic concrete.

A Gradall was used for stripping away the existing bituminous surface from the grid, and the west bound lanes for the entire bridge length, 1906 feet, were cleared the first week. For the duration of the job, traffic then ran on the open grid until the new decking went on, section by section.

First step was installing the 12 by 36-in. 14-gauge steel plates, punched

with 72 holes to allow for condensation. The plates, furnished by the state, had to be perforated by the contractor according to specification and were painted on both sides with Bitumastic Koppers No. 50 prepara-

tion. The plates were secured to the underlying grid by 4-in. long welds on 5-in. centers across the lane width.

Next 3/8-in. square spacer bars were placed where the paver's tracks were to travel. Purpose of the spacer bars was to raise the welded wire reinforcing fabric up into the asphaltic concrete, where it most effectively stabilizes the mix. The fabric, in sheets 11 1/2 feet wide and 8 feet long was positioned so that the three-inch spaced wires were at right angles to the axis of the bridge.

The mix, known as Connecticut 1-21-F, dense graded bituminous concrete, had a synthetic rubber additive. The base was 1 3/4 inches before compaction, tapering to 3/4 inch at the edge, and the top, 1 1/2 inches thick, tapering, with a maximum roadway crown of 2 7/8 inches. A Barber-Greene paver was used to lay both base and surface course. A 10-ton Galion tandem roller was used for compaction.

The fabric-asphalt combination was designed by Connecticut Highway Department engineers. Ray Mallon, Fairfield County resident engineer, and Marvin Rapp were state highway engineer representatives in the field. The project was let for \$144,684.70.

Bin-Type Retaining Wall Solves Sliding Fill Problem

AN ARMCO bin-type retaining wall 270 ft. long and 26.67 ft. high has been constructed in Racine, Wisc., to support Water Street which closely parallels, but is about 30 ft. higher than the Milwaukee Railroad tracks. After many years of service, the original retaining wall began to fail under the heavy load. The bin-

type wall was selected for replacement because of ease and speed of installation and the fact that this type permits stage construction.

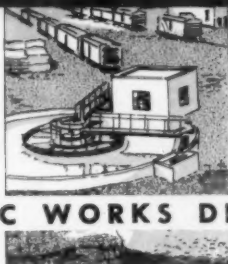
As the wall tipped, the fill behind it sank and the pavement, which is of brick, failed. Following the new construction, the pavement was relaid quickly.



● WHEN a 30-foot high retaining wall to the left of this street started to crack and tip, this brick-surfaced street in Racine, Wisconsin, began to slide down to the tracks below.



● ARMCO bin-type retaining wall proved its worth in these close quarters by the railroad. Here the new metal retaining wall is partly completed, taking the load off the existing wall.



PUBLIC WORKS DIGESTS

Prepared by

CLAYTON H. BILLINGS

Associate Editor

THE INDUSTRIAL WASTE DIGEST

Paper Mill Waste Treatment Results

Before the installation of the waste treatment plant by the West Virginia Pulp and Paper Co. at Covington, W. Va., the firm made considerable strides in controlling and eliminating pollution at the sources of the wastes. The production of activated carbon was sparked by such efforts. Activated sludge was selected as the waste treatment process primarily because the mountainous terrain at Covington precluded the use of lagoons and trickling filters. The plant, placed in operation in 1955, has a design capacity of 16 MGD, about two-thirds the waste flow from the mill. The low-BOD effluents, high in volume, are not treated. Two-thirds of the flow is treated in a primary clarifier, while the remaining one-third, which is low in suspended solids is by-passed to a mixing chamber. This latter facility collects the primary clarifier effluent and provides a place for mixing it with returned activated sludge and the added nutrients, ammonia and phosphoric acid. Combined aeration and final settling units are operated in parallel. Virtually every major operation in the plant is governed from a central control panel, the arrangement making it possible to use only one operator per shift to run the plant. Control of the influent pH is a source of difficulty in plant operation, against which the only protection is excess activated sludge in storage. The high chlorine concentration of the bleaching wastes caused difficulty until the solution was found—mixing them with the high-chlorine demand pulping wastes. One of the unsolved problems is the application of standard analytical methods. Dissolved oxygen has to be measured with a polarograph, for example. Other problems are color removal, frothing, and scaling of plant appurtenances. The final effluent manhole employs an automatic butterfly valve for controlling the level in the manhole so that the outflow is always from under the liquid level, thus keeping the froth out of the

outfall. The plant removes 75 to 80 percent of the BOD of the wastes treated and 85 to 90 percent of the total solids. Studies are being conducted to bring about better understanding of the problems encountered.

"Activated Sludge Treatment of Kraft and Neutral Sulfite Mill Wastes." By B. V. Pearman, Jr., and O. B. Burns, Jr., *West Virginia Pulp and Paper Co. Sewage and Industrial Wastes*, October, 1957.

Pharmaceutical Waste Plant Expanded

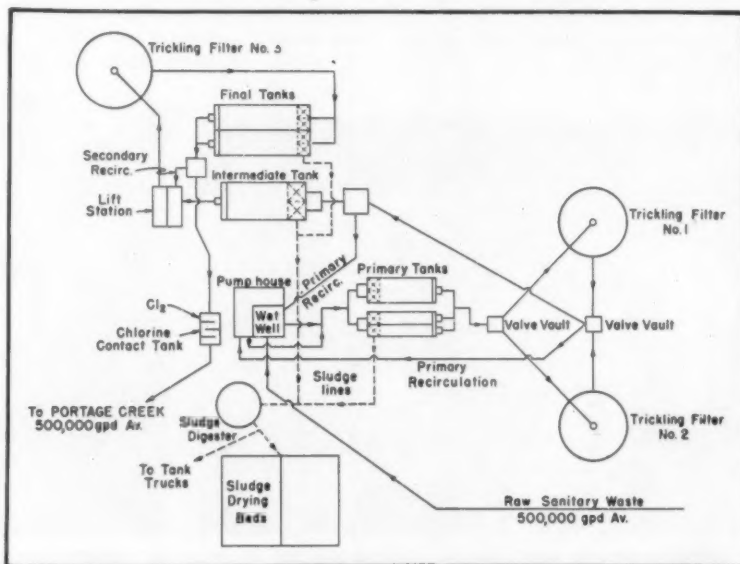
The Upjohn Co. installed its plant for processing pharmaceutical wastes in 1948, handling at that time only the antibiotic wastes. Among the early operating troubles were insufficient digester volume and ponding of trickling filters from grease and slugs of spent beer. These were solved by providing increased digester capacity, grease removal, and aeration of spent beer. In 1952, as a result of increased production, the treatment plant had to be expanded. A new primary clarifier was instal-

led, and the two old ones were used for intermediate settling between the two primary filters and the final filter. Make-up water from the filter effluent for constant flow re-circulation is controlled by an automatic valve. Air-liquid jets were selected for use in the pre-aeration tank for the antibiotic beer wastes. Aeration was added to the grit removal tanks also. About five years of experience using *Daphnia* for toxic waste evaluation has shown that if *Daphnia* are killed, the samples for BOD tests need seeding. The BOD samples are collected and proportioned automatically. The expanded waste treatment plant has done a good job with two-stage filter operation, permitting fast recovery from overloading with toxic or strong wastes.

"Two-Stage Filter Operation at the Upjohn Waste Treatment Plant." By L. B. Tompkins, *The Upjohn Co. Sewage and Industrial Wastes*, October, 1957.

Research Produces Waste Problems

Work at the General Electric Co. Research Laboratory comes under



Courtesy Sewage & Industrial Wastes

● FLOW DIAGRAM of two-stage filter for treating Upjohn Co. industrial wastes.

unbeatable combination

in sewage treatment:

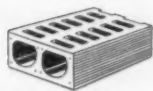
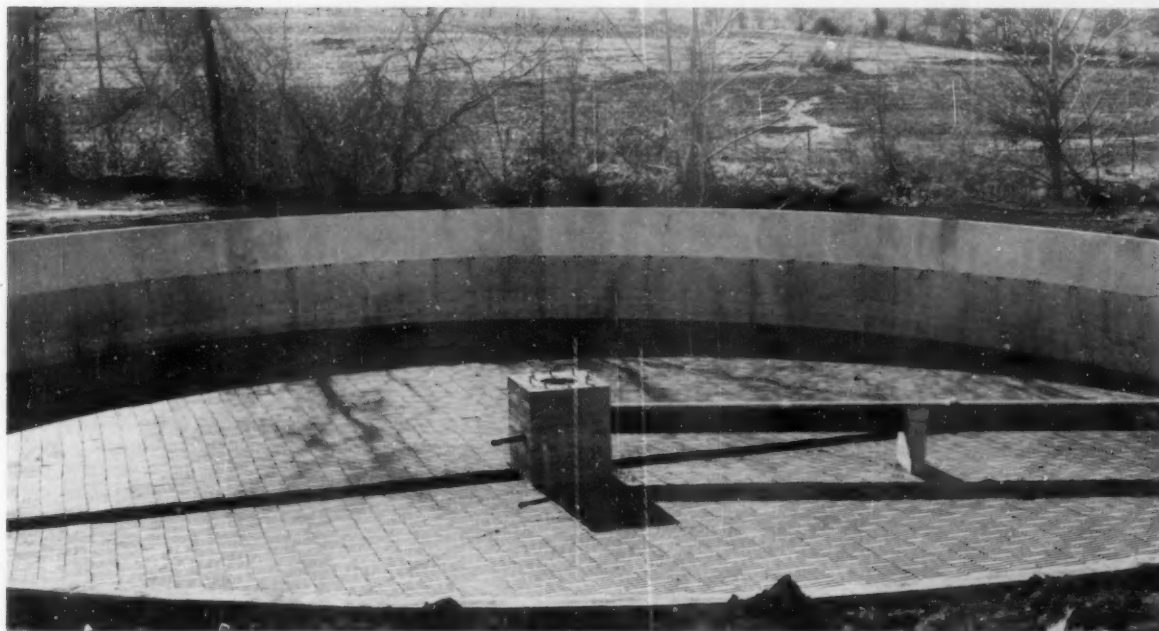
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Clay Blocks are best because:

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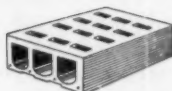
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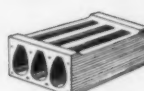
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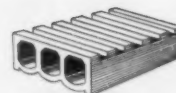
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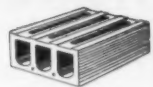
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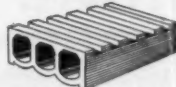
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three divisions, basic research, applied research, and development. They may involve as many as 300 simultaneous projects and call for an average water use of 0.5 MGD. There are 13,000 different chemicals on the shelves, from which the researcher may help himself. In most cases the resulting waste may be diluted with the entire plant discharge, without adverse effect. Some chemicals develop hazards, however, requiring special techniques. Water-soluble solvents, such as acetone and ethanol must be equalized in large volumes of water to avoid flammable vapors. There are problems with

acids and other liquids which react violently with water, such as sulfuric, nitric and perchloric acids and acetic anhydride, bromine, and acetyl chloride. These and compounds which may produce dangerous reactions in sewers are kept out of the sewers, being placed in metal containers for daily removal and disposal by burning. Other chemical and laboratory wastes flow into an equalization tank to smooth out peak acid or alkali concentrations, and from there the wastes join the treated sanitary sewage, affording additional dilution for both wastes. A survey was undertaken in 1954 to

determine whether the laboratory wastes were affecting the Mohawk River. Aside from applying the usual laboratory indices of stream pollution, measurement of heavy metals spectrographically and visual observation of the physical appearance was recorded. A movie camera and timer were set up to monitor river conditions at the outfall, with a frame per minute of color taken during daylight hours. The survey confirmed that dilution was satisfactory and did not contravene the Class "B" standards established for the Mohawk River.

"Liquid Wastes Control at the General Electric Company Research Laboratory." By V. deP. Lukas and H. M. Ottaway, General Electric Co. *Sewage and Industrial Wastes*, October, 1957.

Batch Slurry Treatment Of Radioactive Wastes

Radioactive materials can be removed by ion exchange from water by column operation or by a batch slurry process. Ion exchange materials studied to evaluate the batch slurry process were Amberlite MB-3, Amberlite XE-69, Zeo-Dur, and Permutit Q. Oak Ridge tap water was contaminated with various radioactive β emitters to an initial concentration of 4000 counts per minute per ml. Ion exchange resin was added to 500-ml. samples to give concentrations varying from 450 to 2700 ppm. The treated samples were stirred for 90 minutes at 216 rpm. Samples were taken every 15 minutes throughout the 90-minute cycle, and were filtered, dried, and counted. The batch-slurry treatment is not as efficient as column type operations with ion exchange resins, but equilibrium is reached very rapidly, with substantial decontamination achieved in 15 minutes.

"Removal of Radioactive Contaminants from Water by Ion Exchange Slurry." By W. J. Lacy and D. C. Lindsten, Oak Ridge National Laboratory. *Industrial and Engineering Chemistry*, October, 1957.

Industrial Wastes Admitted Under FSIWA Ordinance

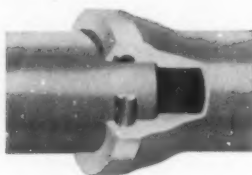
Wastes from two textile mills, an electric meter manufacturing plant, laundries and commercial establishments will be admitted to the sewage flow of Raleigh, N. C., to be treated at its 12-MGD plant. The textile mills will be requested to comply with an ordinance under consideration at present, patterned after the model code published by the Federation of Sewage and Industrial

"You just
PUSH IT
together!"



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2" & 2¼" cast iron pipe




Cutaway to illustrate position of Tyton gasket inside assembled joint.

The only joint accessory is the gasket. Simply insert Tyton gasket into bell and push plain-end of next pipe into place. That's all there is to it. Lays fast, at lower cost. Leak-proof, flexible joint. Tyton Joint Pipe is centrifugally cast in 20-foot lengths . . . is easy to cut and tap. Write for illustrated literature.

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OR DO BOTH IN ANY PROPORTION...

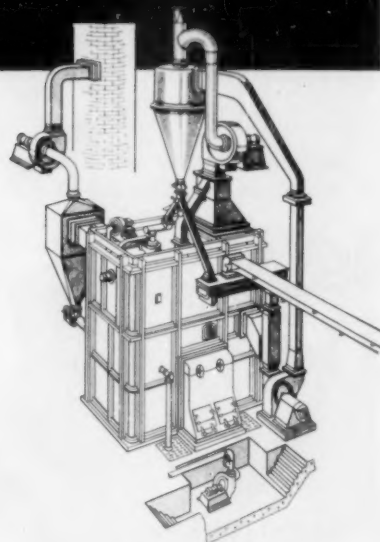
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The widespread acceptance of the C-E Raymond System is based on its solid advantages. This compact system combines the principles of Flash Drying and Incineration in a unit in which filter cake can be reduced to a sterile ash... or flash-dried to a salable fertilizer and soil conditioner. Revenue from the latter is often sufficient to pay a substantial part of plant operating costs.

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B-998



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Wastes Associations. The meter manufacturer, Westinghouse Electric Co., which discharges 0.183 MGD of acid, alkaline, cyanide and other chemical wastes, now has a pretreatment plant. The acid and alkaline wastes are neutralized before being combined with the effluent from cyanide waste treatment. Under the ordinance the city is expected to adopt, all industries must secure a permit stating the quantity and type of wastes and the kind of proposed pretreatment. The city is encouraging industrial expansion and will cooperate with manufacturers to provide sewer service for plants outside the city limits.

"City Encourages Outlying Industries to Pretreat and Contribute Wastes." By E. M. Johnson, Director of Public Utilities, Raleigh. *Wastes Engineering*, October, 1957.

Other Articles

"A Broad Picture of Industrial Waste Pollution Abatement." By Blucher A. Poole and P. E. Miller, Indiana State Board of Health. How well industry,

regulatory agencies, engineers, plant operators and interested citizens do their respective jobs and sell industrial waste control, will determine future industrial development of the Ohio River Valley. Right now, the picture is very bright. *Sewage and Industrial Wastes*, October, 1957.

"An Investigation Into the Disposal of Blood by Anaerobic Digestion." By K. B. Singleton, Supt., Sewage Treatment Plant, Kent, Ohio. Blood from packinghouse wastes intensifies problems when added directly to a sewage plant digester. *Sewage and Industrial Wastes*, October, 1957.

"A Treatment for Oily Waste Water—Part III." By W. B. Hart, Pantech, Inc. Chemical control is critical in the flocculation of "white water" of petroleum refinery wastes. *Industrial and Engineering Chemistry*, October, 1957.

"The Waste That Couldn't Be Treated." American Cyanamid's difficult waste will be handled in a 20 MGD activated sludge plant, costing \$4.5 million. *Engineering News-Record*, October 3, 1957.

"Disposal of Power-Station Ash into the Sea." Disposal will be attempted by discharging ash into a culvert carrying cooling water at a low-water mark level. *The Surveyor*, October 19, 1957.



ART DIRECTING
for Visual Communication
and Selling

Increasingly city and county officials have the responsibility of "selling" their performances, their programs and their community advantages in the form of reports to voters and others. This also applies to the production of booklets and other means for attracting desirable new industries or businesses.

This attractive volume, "Art Directing for Visual Communication and Selling," contains much helpful information that can be utilized in such projects in connection with the employment of professional advertising and layout specialists and artists. While the text and illustrative matter of this book is of high professional authorship and quality, its salient points can be grasped readily and appreciated by the layman in art matters. And its stimulative value is immense.

In brief, for all whose basic problems have to do with how best to get

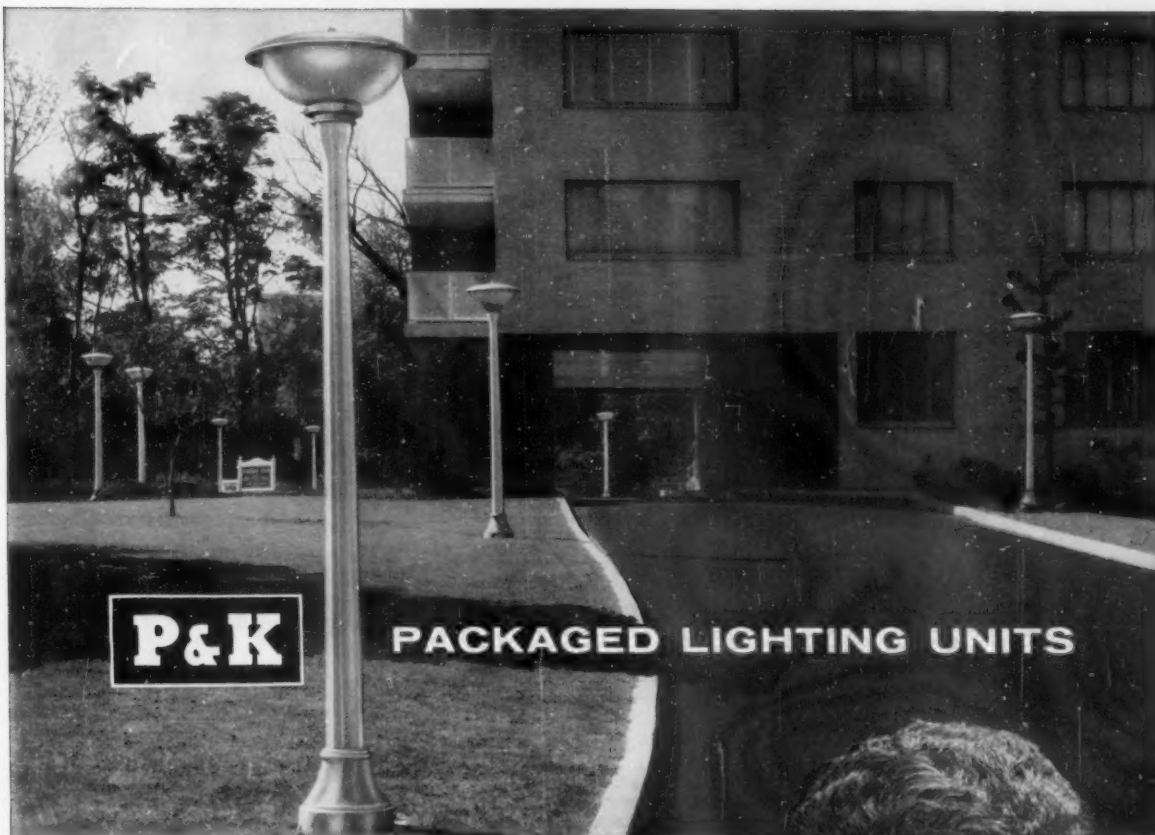
an idea across, here is help, information, inspiration and guidance by experts.

It is with a special sense of pleasure and appreciation that we present this book review, since the Editor-in-Chief of this new volume is Nathaniel Pousette-Dart, an international figure in the art direction world who has served as art consultant for PUBLIC WORKS for a number of years.

"Art Directing for Visual Communication and Selling" is published by Hastings House, 41 East 50th Street, New York 22. 238 pages, lavishly illustrated, in colors. \$15.00.

**AMERICAN STANDARD
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Designed to assist plant officials responsible for guarding against trespassing and theft, American Standard Practice For Protective Lighting, has been published by the Illuminating Engineering Society. The book defines and gives the principles involved in plant protection, followed by a discussion of the boundaries and approaches to an industrial plant and the various types which may be encountered. Another section covers the lighting problem with respect to areas and structures within the property lines. Copies are 50¢ each and are available from Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.



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● A SECTION of the Poz-O-Pac base, plus wearing course, which was removed after approximately eight months of service. Unconfined compressive strength tests at this time showed 1,200 pounds per square inch.

Poz-O-Pac Road Base *SHOWS* *LOW FIRST COST AND HIGH QUALITY*

UNDER THE supervision of Eugene Compton, Salem County Engineer, and the New Jersey State Highway Department Soils Division, 3.5 miles of federal aid secondary county roads were constructed in the summer of 1956 using the mixed-in-place Poz-O-Pac method (a lime - flyash - aggregate mixture for road base construction). This section required a high quality base construction, as it is one of the arteries from the newly constructed Delaware Memorial Bridge into southwestern New Jersey.

Analyses and tests performed by the New Jersey State Highway Department Laboratory indicated that a mixture of road gravel, 5 per cent

lime, and 10 per cent fly ash would form a composition, the properties of which would permit its use under high frequency heavy traffic loads. On this basis a design consisting of 6 inches of Poz-O-Pac road base and 1½ inches of New Jersey FABC-1 bituminous concrete placed on a course of select material was adopted. In March, 1956, proposals were issued and the job was let to South Jersey Construction Company of Riverside, New Jersey. The Poz-O-Pac base course, excluding rough grading, cost the county 49¢ psy. The bituminous wearing surface consisting of 165 pounds of New Jersey FABC-1 cost 91¢ psy, for a total of \$1.40 psy.

After initial sub-base work and grading had been accomplished, Poz-O-Pac construction was started on August 27. Hydrated lime supplied by G. & W. H. Corson, Inc., of Plymouth Meeting, Pennsylvania, was hauled to the job in bulk by means of Gramm air slide trailers supplied by Coastal Tank Lines Company of York, Pennsylvania. Bulk hydrated lime was spread by means of a Hercules bulk cement spreader. In addition to the above, some bagged lime was imported from the same supplier in order to finish up small sections which could not be supplied conveniently by the bulk carriers. Dampened fly ash supplied by Corson from Delaware



● LIME for the Poz-O-Pac base was spread with a Hercules bulk cement spreader attached to the rear of the big trailer.



● COMPONENTS of base were mixed with a Pulvi-Mixer. Moisture for maximum compaction was added on last pass.



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● THIS IS A VIEW of the finished roadway at the point where a section of the base was removed. The Clipper saw was used to cut out the test section of base.

Power and Light Company's Edge Moor Station was trucked to the site in conventional dump equipment supplied by the contractor. The spreading of fly ash was accomplished by tail gating from the dump trucks and spreading to grade with a motor grader.

After the spreading operation, the gravel was scarified and windrowed with motor graders in order to insure that proper depth of mix would be achieved as the Pulvi-Mixers went into action. An intimate blend of the mix components was accomplished by three to five passes with the Pulvi-Mixer; and as the last pass was made, the moisture content was brought to optimum in order to obtain maximum compaction. Initial compaction was accomplished with a conventional 11-tire rubber wheel roller followed by fine grading and final compaction with 10-ton tandem roller.

After compaction, the Poz-O-Pac base was opened to local traffic; and although severe rain storms occurred before the wearing course was applied, it was noted that no ill effects developed due to this condition.

The Wearing Course

Having completed the base course construction, the contractor applied 0.1 gallon psy RCO tack coat and placed a wearing course of FABC-1 plant-mixed bituminous concrete compacted to a thickness of 1½ inches.

After the job had been in service for approximately eight months, test sections were removed. Unconfined compressive strength tests at this time showed 1,200 pounds psi.

While Poz-O-Pac is relatively new in federal aid county use, highly successful jobs have been put into service over the past eight years and represent a variety of designs under all traffic conditions including airfield runways, taxiways, highways, city streets, parking areas and road shoulders.

The early Romans utilized pozzolanic volcanic ash and crude hydrated lime in their masonry mortar and hydraulic concrete with outstanding success. Many of their buildings and structures in Europe are in excellent condition today. In an effort to duplicate some of these formulas, two engineers of the Philadelphia Electric Company, one of the country's largest producers of the man-made pozzolan—fly ash, undertook a research study. During the course of this investigation they made a remarkable discovery and developed the compositions which were capable of producing unconfined compressive strengths of the order of many thousands of pounds within relatively short periods of time. It was this discovery that led engineers at G. & W. H. Corson, Inc., into the development of the road base composition. Thus for the first time a road mixture was available which enabled engineers to utilize aggregate materials which are normally unacceptable for conventional base construction. This has opened the way for use of many in-place materials and for a variety of low cost aggregates which are available in the operations of stone quarries.

In 1948 the Corson organization placed their first test sections and to obtain realistic answers, so lo-



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René Ouellette has operated tractor-shovels many years for the North Adams (Mass.) Highway Department and really knows loaders. After clocking more than 600 hours on their new 4-wheel drive HU "PAYLOADER" with no downtime, he commented, "hydraulic load shock absorber and pry-out roll-back bucket action at ground level are the greatest advancements ever made on a loader." The true value of these two *exclusive* Hough features is emphasized by this experienced operator when he says, "this machine has the greatest breakout force I ever experienced on any machine . . . it's very easy to operate, less tiring and it gives me a true sense of safety."

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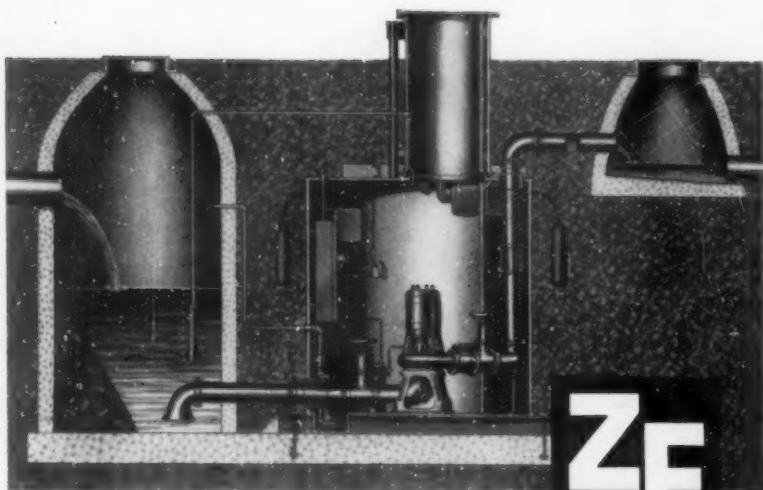
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cated these sections that Corson's large, heavily loaded quarry trucks would utilize the pavement on each trip to and from their primary crushers. The results of this field test indicated that the product surpassed expectations. Since that time over 1,000,000 square yards of Poz-O-Pac road base have been constructed and put into service, approximately one-half of which has been in service for four years or more.

Poz-O-Pac Company of America, a subsidiary of G. & W. H. Corson, Inc., maintains a complete consulting and engineering department and has a well-equipped soil testing laboratory in which project mixtures are designed. Recommended designs take into consideration such factors as sub-grade strength, drainage conditions, traffic frequency, loading, and prevailing weather conditions. In general, most design methods now in use by highway departments, Corps of Engineers, CAA, etc., for determining base and sub-base thickness requirements may be used for Poz-O-Pac base design.

• • •

Transportation Needs in 1978

A transportation study is being made in the Chicago area. Now about two-thirds completed, it will be finished late in 1958. It will project all types of transportation requirements for the next 20 years based on land use, employment, traffic generation, and similar factors. The survey covers an area of 1,250 square miles with an estimated 5,000,000 inhabitants. Data are being gathered on land use for each parcel of real estate in the area; traffic generation for each 100 square feet of floor space in every building; the length, width, and number of stories in each building; area data on streets, alleys, and vacant land; and traffic generation and travel patterns for all types of transportation including automobile, rail, and truck. Extensive mapping operations and many thousand interviews are utilized to project the 10,000,000 trips made on an average weekday by all types of transportation. Punch card data are being tabulated and stored electronically so that desired information can be mapped.

• • •

City Has Street Marking Project

A street-marking project in Gadsden, Ala., involved 3467 street name plates, 1167 posts and 2734 brackets. Total cost was \$18,237.

RECHARGE OPERATIONS CAN CONSERVE WATER RESOURCES

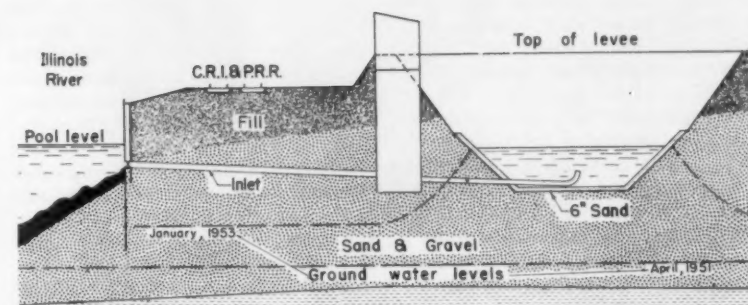
This is an abstract of an article published in The Johnson National Drillers' Journal.

THE PEORIA experimental infiltration pit completed five seasons of operation in May, 1956. A report by the Illinois State Water Survey gives the results obtained for the 1955-56 season and compares them with data from the previous years. The total recharge to ground water was 423 million gallons, the highest seasonal total thus far. Further understanding of the factors affecting this method of recharge was developed.

The Peoria pit, one-seventh of an acre in area, is on the west bank of the Illinois River and is excavated to a depth of 10 feet below the controlled pool level of the river. An intake structure and suitable controls admit river water under gravity flow to the pit through a 12-inch line. All of the recharge water is chlorinated. The large quantities of silt which must be filtered during these recharge operations is indicative of the problems involved.

A second recharge pit was constructed in 1956 and is now in operation. The main purpose of the new pit is to provide information so that the distance needed between recharge areas to insure full inflow can be determined. The side slopes in the new pit were made flatter than those in the first one because experience has shown that most of the recharge occurs through the side walls rather than through the bottom area.

Bemis Brothers Bag Company built a recharge pit at Peoria designed in accordance with the findings of the Water Survey. It has operated since January, 1956, and has a high rate of inflow. The Peoria Water Works Company has also developed a recharge facility which is designed more like a land-flooding installation, but its



● **CROSS-SECTION** through the Peoria recharge pit which is operated for research purposes by the Illinois Water Survey. This pit is one-seventh of an acre in area and handled an inflow of 423 million gallons during the 1955-1956 operating season.

rate of inflow is somewhat lower than the other pits.

Conservation of water resources through recharge operations has been practiced for 20 years in Nassau County on Long Island, New York. Large recharge basins used to put storm water into the ground have been in operation since 1936. The basins usually are divided into two sections; one is an impounding basin in which silt settles out before the water flows into the recharge basin proper. The detention basin also permits skimming off any oil which the storm water may have carried off streets recently oiled or tarred.

Storm water diffusion wells are used in some areas of Long Island where it is not feasible to construct recharge basins. Ground water is also conserved by using wells to return ground water pumped for cooling or air-conditioning.

Important facts about the Long Island recharge basins were reported to the New Jersey section of the AWWA by W. Fred Welsch last year. Mr. Welsch said, "One of the largest recharge basins is in Garden City. The length is 648 feet; width 402 feet; and depth, 11 feet. The area drained is 2,080 acres. The basin has a capacity of 3,685,000 cu. ft. with a floor area of 224,-

900 sq. ft. Smaller basins have capacities of 60,000 cu. ft. or less. For optimum results, the bottom of the recharge basin should be from seven to 10 ft. above the static ground water level.

"Estimates were made of the rate of seepage, based on heads varying from 0.5 to 9 ft. in depth; average results indicated a recharge rate of 23 gals. per sq. ft. per 24 hrs. With a safety factor of two, a design rate of 11 gals. per sq. ft. per day was used, or about $\frac{1}{2}$ mg/acre/day.

"To keep seepage rates at maximum values, the basin floors are harrowed with a smooth-wheel harrow twice a year. The surface penetration of this harrow is two inches, with the depth controlled by a hydraulic lift on the tractor. Harrowing is done when the basin floors are dry and when weed growth is small. This operation kills all weed growth and keeps the bottom clean and the surface opened and porous. The impounding basin at the inlet receives most of the silt, so only small amounts of silt accumulate in the seepage basin. However, if this thin layer of silt is not broken up, it seals the surface and will in a short time diminish its capacity for seepage. Harrowing at controlled depth is the best answer."

The average daily pumpage of ground water on Long Island in 1954 was 312 mgd. This represents an increase of about 15 percent in five years. It is estimated that 40 mgd of storm water is recharged in Nassau County through pits. There is no estimate of the amount of storm water recharged through diffusion wells. However, about 40 mgd of the ground water pumped on Long Island for air conditioning in 1954 was returned to the ground through recharge wells.

Activated Sludge Treatment for INDUSTRIAL WASTES

A. PRESCOTT FOLWELL

THERE HAS BEEN a wide-spread belief that biological methods of waste treatment, particularly the activated sludge process, must be conducted under very closely controlled and well defined conditions to produce satisfactory results; that the pH must be between 7 and 8, the temperature be kept practically constant, the sludge fed daily, and other details of procedure be sedulously observed. Many industries produce wastes with pH above or below the optimum, wide fluctuations in temperature and prolonged periods of starvation. The subject was investigated by Prof. C. N. Sawyer of the M.I.T.; John D. Frame, Research Engineer; and John P. Wold of the U.S.P.H.S. under a grant from the National Institute of Health, U. S. Public Health Service, and the following conclusions reported in 1955:

1. Adaptation of activated sludge to temperature change is immediate.
2. Temperature fluctuations at 12-hr. intervals between 10° and 30°C. (50°-86°F.) are not detrimental to sludge quality.
3. Biological purification of wastes with pH ranging from 5 to 11 can be accomplished by activated sludge, provided acids are not formed to depress the pH below 5.
4. The pH effects are a function of temperature. At low temperatures the effects are magnified. Thus, closer attention should be paid to pH control during the winter than the summer.
5. Levels of pH above 9 are definitely inhibitory at 10°C. and levels above 10 are definitely inhibitory at 20°C.
6. The decision concerning the degree of neutralization prior to treatment should be based on an engineering cost study comparing the cost of chemicals with larger plant facilities.
7. Automatic pH control is required when treating wastes that offer the threat of decreasing the pH below 5 due to acid formation.
8. Activated sludges may be starved for periods of at least 3 weeks without seriously impairing

their purification capacity. Full purification capacity will be restored in 2 to 5 days after resumption of feeding at full load.

Since this investigation got under way, many tests and trials of the use of activated sludge for treating a wide variety of industrial wastes have been conducted by individual plants, laboratories or other agencies. Among the wastes so studied and conclusions published are chemical, citrus, paper mill, packing house, petroleum, phenols and other aromatics, photographic, plating, and refining.

Kraft Pulping Wastes

The first large scale activated sludge plant for treating wastes from the kraft pulping process was put into operation early in 1955 by the West Virginia Pulp & Paper Co. at the Covington, Va., plant. This followed the operation for about two years of a pilot plant, which had revealed that BOD, chemical oxygen demand and color could be reduced by 94%, 72% and 43% respectively at loadings of 75 lb. of BOD per day per 1,000 cu. ft. of aerator capacity. This plant was designed to treat 8 mgd from the pulp mill, mixed with and neutralizing 8 mgd of the acid wastes from the bleach plant, the mixture then being aerated and settled, the excess sludge being disposed of in a lagoon.

The E. I. du Pont de Nemours Co. several years ago began treating wastes from the manufacture of photographic film by the activated sludge method, using a suspended solids reactor. The waste material treated includes ethanol, methanol, acetone, diacetone alcohol, gelatin and small amounts of silver salts. Satisfactory activated sludge was obtained if the pH was kept within a range of 6.5 to 8.5; but it was reported in 1955 that, if the pH of the influent was below 5.0 or above 9.0, operation of the unit was upset. The activated sludge thrived at temperatures between 70° and 100°F. When the wastes have a wide range of characteristics the treatment is successful if provision is taken to maintain the pH and temperature within the desired limits with 24-hr. 7-day week supervision.

A number of packing houses have used the activated sludge method successfully in treating their wastes, following removal of much of the solid matter by screening and/or sedimentation. A report in 1955 concerning such treatment by Braun Brothers Packing Co. of Troy, Ohio, showed a BOD removal exceeding 85%. The plant was designed to treat 550,000 gpd with a total load of 4,000 lbs. of BOD per day. At the time of the report the plant had been treating about 400,000 gpd with 3,220 ppm suspended solids and 1860 ppm BOD with 96.8% removal of suspended solids and 96.1% removal of BOD. Provision had been made for chemical pretreatment before the waste entered the primary tank, but had not been necessary. Waste flow started at 7 A.M. and continued at a comparatively low and erratic rate until about noon; the bulk of the waste being received at a very high rate during the next 5 hours. During the next 14 hours the tank effluent was treated by double aeration.

In another case, that of the Reel-foot Packing Co. at Union City, Tenn., the company pretreated their wastes and discharged into the city sewer a liquid with a BOD of 500 ppm which constituted 25% of the total sewage treated and 50% of the BOD. The combined waste and domestic sewage was treated by the activated sludge system, following passage through settling tanks and a roughing filter. The plant was designed for a BOD loading of 2665 lb. per day. The retention time in the aeration tanks is 5 hr.

Phenolic Compounds

The biological treatment of phenolic and related aromatic compounds was the subject of a study made at the Massachusetts Institute of Technology in 1955. It was concluded that activated sludge is quite well suited for treating phenolic and related aromatic compounds; that these aromatics were not toxic to activated sludge in concentrations up to 500 ppm phenol; that oxidation of the aromatic compounds was limited by the rate of oxygen transfer and was a function of the chemical structure of the compound; and that oxidation of aromatics appeared

to be by beta-oxidation rather than by direct oxidation of the ring structure to catechol.

Tests were conducted by the Atlantic Refining Co. in a large pilot plant in 1955 on the treatment by activated sludge of its waste waters, which included oils, waxes, phenolates, caustics, acids and many other organic and inorganic contaminants. These tests proved that the wastes were treatable by activated sludge, but modifications to adapt the aeration process to refining wastes and better preparation and conditioning of the influent were indicated. In using a high-rate activated sludge process the sludge tended to float in the clarification unit and use of dissolved air flotation in place of final sedimentation was suggested.

The Sarnia Refinery of the Sun Oil Co. treats process wastes containing the main oxygen-consuming contaminants, consisting of a 200 gpm flow containing more than 95% of the phenols, sulfides, mercaptans, emulsified oils and other contaminants. Activated sludge was adopted primarily to reduce phenol and phenol derivatives because of low investment cost, anticipated high oxidation efficiencies and the availability of low-cost electric power. Another advantage of this treatment is the possibility of utilizing sludge recirculation in the aeration basin for metabolic oxidation or endogenous respiration of excess bacterial growth, thereby eliminating separate digestion equipment. Other refineries using activated sludge in 1956 were the Imperial Oil Co. treating 245 gpm of waste containing 800 lb. per day of phenols; and the General Petroleum Corp. treating 300 gpm containing 720 lb. of phenol.

Citrus Wastes

Experiments on the treatment of citrus plant wastes have been conducted in Florida. The Florida Citrus Experiment Station reported in 1956 on the application of the activated sludge process to such treatment, based on studies of a pilot plant consisting of a surge tank, an aeration tank using compressed air, and a clarifier. The BOD concentration in the raw waste was extremely variable—from 2,000 to 20,000 ppm, apparently depending primarily on the proportion of peel bin drainage. There was about 29% BOD reduction in the surge tank and an overall reduction better than 99% during the last 14 days. During periods of overload and poor operation, slime-forming organisms became prolific.

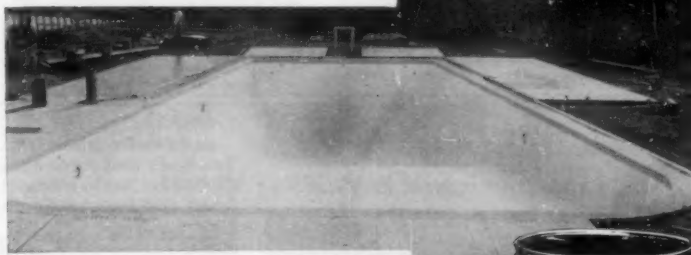
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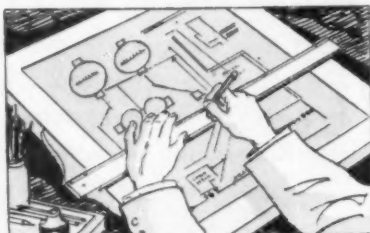
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Furniture for the Sewage Treatment Plant

A municipal report reaching us recently carried the following state-ment: As the result of a question by a citizen, an investigation was made of the furniture proposed for the Sewage Treatment Plant additions. We were amazed to find that the consultants had specified furni-ture more fitting for the office of a corporation president. The bill, totaling \$13,600, included 3 desks at a cost of \$690 to \$770 each. All furniture will be deleted from the general contract and purchased by the City directly. The resultant savings in consultant's and contrac-tor's fees, plus the selection of more appropriate furniture will result in a saving of approximately \$7,000.

• • •

Financing Off-Street Parking by Assessment

Parking space for 183 automobiles in the central business district of San Mateo, Calif., has been pro-vided by the benefit assessment method. The central portions of two and one-half blocks in the business district were purchased by the city in late 1956 for \$584,100. The entire cost for the project is \$700,000, or \$3,840 per parking space. The assessment district is limited to property within 600 feet of the parking lots with three zones pay-ing 50, 30, and 20 percent according to distance from the lots. Free park-ing is limited to two hours. Bonds will be retired over 30 years by land value assessments in the benefited area.

• • •

Peak Hourly and Daily Water Use in Chicago

A total of 377,539 billion gallons of water was pumped by Chicago dur-ing 1956—slightly more than a bil-lion gallons per day. The peak day for the year was June 13, when the pumpage amounted to 1,412 million gallons; and the peak hourly rate occurred at 7 pm the same day. This was at the rate of 1,695 million gallons per day.

• • •

Louisville Incinerator

(Continued from page 111)

The can processing equipment from the can storage hopper to the baled conveyor discharge at the railroad siding will normally operate about eight hours per day. Cans from the can storage hopper (N)

are carried by a drag conveyor and discharged into a Dempster baler. This produces bales about 14-in. x 14-in. x 20-in. in size which weigh about 400 pounds. Bales are pushed by the baler onto a heavy duty type apron conveyor (O) which discharges the finished bale direct into cars on the railroad siding. The bale conveyor was furnished by the Beaumont Birch Company.

The incinerator unit's sifting conveyors, residue conveyors, complete can processing equipment, motors, control panels, instruments, etc., were all furnished and installed complete by International Incinerators Inc., Atlanta, Georgia.

Building

The building is of modern design, using glazed structural tile for the interior with a red brick exterior. Red quarry tile is used for all the main plant floors. The area enclosing the crane and storage pit area is corrugated glass for maximum light at all times. Every effort has been made to provide for a plant that is functional, easy to maintain and keep clean.

City Goes "On the Air"

(Continued from page 117)

two-way radio has an important part. One rather frequent request for help from residents is that of retrieving keys or wallets accidentally dropped into catch basins; the radio has speeded this operation to the great relief of the individuals. In winter, during snow removal operations, the radio has been of immense value, particularly in the winter season of 1955-56 when we had 109 inches of snow. The Sewer Division operates in a similar manner, especially on plugged house connections and cleaning storm drains. The Forestry Division, which has charge of all trees located on city property, has one unit which has proven of great benefit especially during high windstorms and dangerous falling trees.

To summarize briefly, the two-way radio installations in a city of this size has become a vital necessary working force upon which all personnel depend. The efficiency of the department has increased 100 percent and time has been saved in innumerable instances. The overall result has been a favorable reaction from the taxpayers of the city, especially when a so-called emergency arises; but with the radio, most so-called emergencies become a routine operation with each man familiar with what is required.

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111 Rollins Road, Millbrook, Calif.

PUBLIC WORKS EQUIPMENT NEWS

Erect-Them-Yourself All-Steel Buildings

All-steel utility buildings are offered by Stran-Steel. The units come in a wide range of sizes, from widths of 12 to 120 ft. and in length to any multiple of 15 ft. Windows and doors can be placed anywhere. Buildings can be ordered with any or all walls open. No cranes or heavy equipment are needed for erection. A 36 x 72-ft. Stran-Master can be put up by an unskilled maintenance crew in 180-200 man-hours. There are no nails or spikes to be driven; all framing connections are made through factory-drilled holes by bolting. An exclusive self-leveling structural feature is an adjustable telescoping arrangement of the steel columns. After the columns are



Steel buildings come in several sizes

placed in the ground, their height can be adjusted to correct any construction irregularities and then secured with locking nuts. For further details write Stran-Steel Corp., Unit of National Steel Corp., Detroit 29, Mich., or circle No. 12-1.

Studebaker Trucks in Many Sizes

A wide range of engines, models and gross vehicle weights in Studebaker line of Transtar trucks for 1958 have been announced. Five models in the two-ton medium and heavy-duty series are available. An automatic transmission for the one-ton classification and power steering for the one to two-ton models are provided. A 259-cu. in., 170-hp V-8 is offered in the ½-ton and ¾-ton models and a 289-cu. in., 182-hp V-8 will be used in the heavy-duty units. In the light-duty line, wheelbases of 112, 122 and 131 inches will be available with gross vehicle weight ratings from 4,800 pounds in the half-ton model to 10,000 pounds in the one-ton model. Pick-up bodies will be 6½ to 9-ft. in length,



Half-ton trucks for road construction

51½-ins. wide; stake and platform types will be 8 and 9-ft. For further details write Studebaker-Packard Corp., South Bend, Ind., or circle No. 12-2 on the reply card.

Bel Connector Seals Leaks Instantly

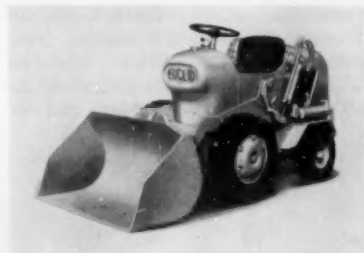
A new Bel connector that instantly seals leaks and makes leak-proof joinings of pipe units is now available from Holoal Mfg. Corp. Easily installed without the necessity of shutting off utilities, draining pipe lines or interruption of service, the Bel connector requires no caulking or soldering. Made of cast iron and oil-and-water resistant Neoprene, the connector creates a cavity around the leak which contains fluid at the same pressure as inside the pipe itself. The seal permits use of the connector with hot or cold water, steam, fuel oil or gasoline at pressures up to 150 lbs. psi. Sizes are up to 6 ins. They can be made to serve as elbows, tees, reducers, and as a take-off reservoir or a distributor with one or more incoming pipes and any number of outgoing pipes. For more details write Holoal Mfg. Corp., 525 Lynn St., Ridgewood, N. J., or circle No. 12-3 on the reply card.

Chemical For Controlling Fish

Chemical Insecticide Corp. announces a new product known as Chem Fish Special "HFN" that is designed for the control of rough fish in reservoirs used for drinking water. The chemical will enable cities and towns with reservoirs to improve local fishing conditions through the use of a non-toxic product without adversely affecting local water supplies. Hundreds of reservoirs can now be made to serve as excellent fishing waters for the citizens of its community. For further details write Chemical Insecticide Corp., 30 Whitman Ave., Metuchen, N.J., or circle No. 12-4 on the reply card.

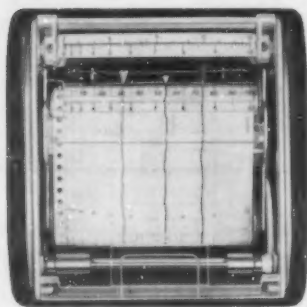
Front End Loader By Euclid

A new front end loader with a rated payload capacity of 19 cu. ft., is announced by Euclid Div. Struck capacity of the bucket is 14 cu. ft. and the maximum lifting load is 3,000 lbs. Designated as the Model L-7, the rubber-tired loader is the first, and smallest in capacity, of several loader models that will be built by Euclid. Conveniently located controls provide instant response and compact design permits operation in confined areas. Equip-



ped with torque converter and power shift transmission having synchronized non-stop high-low shift, speeds range up to 11 mph forward or reverse. The unit, which has rear-wheel steer and front wheel drive, is powered by a 49-hp Continental gasoline engine. The overall operating height is 6 ft. 9½ ins. For further details write Euclid Div., General Motors Corp., Cleveland 17, O., or circle No. 12-5 on the reply card.

Six Consotrol Features Added



Three-pen Model 53 Consotrol recorder

For greater operating convenience, six features have been added to the standard panel-type Consotrol instruments manufactured by The Foxboro Company, which permit greater recorder flexibility in Models 53 and 54 and improve automatic control in Model 58. With the latter, Batch Stabilog control now permits the use of reset action on batch processes without "wind up" or "overshooting" at the start of an operating cycle. Patented Auto-Selector action provides a smooth transfer of reset control selectively for any number of

related variables. A new type chart tear-off bar and a new automatic-manual switch handle are standard with each instrument, while all other new operating features are available as optional equipment. For further information, write The Foxboro Co., Foxboro, Mass., or circle No. 12-6 on the reply card.

Automatic Switching of Street Lights

A new electro-mechanical control for automatic switching of street lighting circuits has been announced by Tuttle & Bailey, division of Allied Thermal Corp. The control, designated the Synchro Switch, by eliminating tubes, transistors, and magnetic relays, avoids heating and "drift" problems, caused by amplification losses and tube aging. The new Synchro Switch uses a cadmium selenide photocell which senses any change in surrounding light conditions and incorporates a synchronous motor and a high-capacity, snap-action switch which turns the street light on or off, depending on light conditions. For complete catalog information, write Tuttle & Bailey, division of Allied Thermal Corp., New Britain, Conn., or circle No. 12-7 on the reply card.

Hydraulic Backhoe Attaches In 30 Seconds

A new hydraulic backhoe with exclusive features of quick attachment and detachment has been announced by the Snap-On-Digger Co. It fits standard make tractors and the all hydraulic unit attaches or detaches in thirty seconds. One conveniently located release lever and a single break-away coupled hose are the only manipulation required to detach, leaving the unit standing on a tripod of the backhoe and the

two hydraulic stabilizers. This frees the tractor for other equipment. Attachment is just as simple. The unit provides more than twelve feet of digging depth, practically nine foot loading clearance and a continuous swing of 190° by means of an easily controlled heavy duty hydraulic system. For full details write the Snap-On-Digger Co., 1115 West Fourth St., Winona, Minn., or circle No. 12-8 on the reply card.



Vacuumized Sweeper Helps Solve Dust Nuisance

A new type vacuumized sweeper was introduced at the recent Public Works Show, by the G. H. Tennant Co. after 3 years of research. Chief feature of the new sweeper is use of vacuum-shrouded brooms and a special dust-filter mechanism, which avoid the necessity of using water spray or other wetting-down agents and attendant mud-streaks. The dust filter can remove grit and dirt particles as fine as 5 microns in diameter. The Model 100 sweeps an 88" path at speeds up to 15 mph. Main pickup broom is 48" long; twin gutter brooms are 32" in diameter. As the brooms revolve in dust-sealed



housings, heavy litter is deposited in a 1 3/4-yard hydraulic hopper at the rear of the machine. Dust is drawn by vacuum from the three brooms and is filtered out of the airstream through a 540 sq. ft. filter. The sweeper has a 92" turning radius facilitating maneuverability. For full details on the Model 100, which will be released early in 1958, write G. H. Tennant Co., 701 N. Lilac Drive, Minneapolis 2, Minn., or circle No. 12-9.

New Accuracy for Detectron Pipe Detector

Improved internal construction of the Detectron Pipe Detector has resulted in easier and more accurate use of the instrument, facilitating the determination of the exact number of pipes which lie in the path of excavating machinery. The design produces a more stable field signal, which permits sharper tuning. This in turn improves sensitivity and allows easier "separation" of pipes which run close together. The improvements have been incorporated into both the standard Model 505 and the Model 505-C Combination Pipe-Leak Detector. For full details, write Computer-Measurements Corporation, 5528 Vineland Ave., Dept. 99, North Hollywood, Calif., or circle No. 12-10 on the reply card.



Sharp bucket teeth on Ottawa backhoe cut the frozen crust



Speedlift Power Packer has added five new design features

Ottawa Backhoe Digs In Frozen Ground

Digging frozen earth at any time, or in any place is difficult but the Ottawa "Big Muscle" backhoe can do the job. Ottawa's patented dual "One-Trols" (two levers which control the dig, hoist, swing and bucket actions) makes this unit easy to handle, even by an unskilled operator. A powerful hydraulic system with mechanical linkage, gives the backhoe plenty of power to

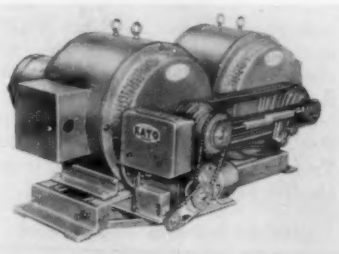
break the crust of frozen earth. The ejector bucket automatically ejects all wet, sticky material from the bucket during the dumping cycle. Ottawa backhoes are available for most popular makes and models of industrial wheel and crawler tractors. For complete details write Ottawa Steel Division, L. A. Young Spring & Wire Corp., Ottawa, Kansas, or circle No. 12-12.

Water Pressure Reducing Valves

Cash-Acme is announcing a completely new series of water pressure reducing valves featuring unusually good capacity in gpm, combined with a stabilized reduced pressure setting performance characteristic. The valves, designated Type E-93 series, provide a high accuracy in degree of regulation. Suitable for service on either cold or hot (to 200°F) water, they are available in ½ to 2-in. pipe sizes. For complete information write Cash-Acme, P. O. Box 191, Decatur, Ill., or circle No. 12-11 on the reply card.



Pressure reducing valves are suitable on either hot or cold water pipe lines



Variable Frequency Motor-Generator With Push Button Adjustment

Convenient push button frequency adjustment at any location can be provided by this 1200-rpm synchronous motor and 1200-rpm revolving field generator set. Generator rating is 5-kw, 3-phase. A motor with reduction gear provides power to alter the pitch of the variable pulleys on both motor and generator. Increase and decrease of speed is accomplished by merely pushing a fast or slow button. Precise frequency and voltage regulation is provided. Control equipment includes magnetic amplifier type voltage regulator synchronous motor starter, load limit switch and reset buttons. Remote control panels can be furnished, enabling remote locations of outlets with frequency adjustment to be installed. For further details write to Kato Engineering Co., Mankato, Minn., or circle No. 12-13 on the reply card.

Safety Features For Refuse Collection Bodies

Five new design features are added refinements to the new Models P20 and P16 (20 and 16 cu. yd. capacity) Speedlift Power Packer refuse collection bodies made by Daybrook Hydraulic. An automatic pressure relief system prevents damage to the force-crush-pack mechanism. The unit can accept, force-crush and pack bulky objects, but when a non-crushable object gets into the hopper the automatic pressure relief system interrupts the cycle and permits the object to bypass the cycle and enter the body. Possibility of a human accident in the mechanism is virtually eliminated by a fingertip cable-control on the body. A new standard option on the models is the choice of either a power takeoff drive or an auxiliary gasoline engine for all operations. In both, operations are driver-controlled from the cab. All mechanical cycling and control operations are now completely hydraulic. The tailgate latch assembly has been changed to flick-action levers on both sides of the body that cam-lock the tailgates securely. For further information write Daybrook Hydraulic Division, L. A. Young Spring & Wire Corporation, Bowling Green, Ohio, or circle No. 12-14 on the reply card.

Lid for Drum Refuse Containers

A self-closing lid to convert 55 gallon drums to sanitary refuse containers is now being manufactured by The Witt Cornice Co. Both the cover and inner hinged flap of the "Big Top" drum lid are made of 22 gauge steel and finished in gray enamel. The flap opening has the word "Push" embossed in red letters. The lid has a 23-¾" I.D. while the dimensions of the flap opening are 16-¾" x 15-¼". Complete information is available from The Witt Cornice Co., 2121 Winchell Ave., Cincinnati 14, Ohio, or by circling No. 12-15.

Sand Spreader Can Be Mounted In 15 Minutes



Fox River sand spreader converts an ordinary dump truck into an ice control unit

A quick-mounting sand spreader manufactured by Fox River Tractor converts an ordinary dump truck into a road spreader within 15 minutes. Quick installation permits converting a fleet of trucks quickly to meet sudden storms. The unit distributes sand, salt, calcium chloride or chips. The spread is adjustable from 8 to 32 feet and the driver adjusts density from his truck cab. Over-the-road speeds may range from 5 to 40 mph. Trucks need not slow down at intersections

to start or stop material flow. Spreaders come in capacities (heaped) of 5, 5½, and 6¼ cu. yds.; the 5-yard box weighs 2280 pounds. Spreaders are powered by a two-cylinder, air-cooled Wisconsin gasoline engine rated 14.6 hp at 2600 rpm. Engine is furnished with starter and enclosed reduction gears. Aggregate screen, 3-in. by 3-in., is mounted on a hinged steel frame. For further details write Fox River Tractor Co., Appleton, Wisc., or circle No. 12-17 on the reply card.

Pneumatic Sewage Ejector System

A new line of pneumatic sewage ejector systems from 20 to 600 gpm capacity, in both cast iron and welded steel, and in single or twin type, is announced by Komline-Sanderson. The systems will also be made as compact, packaged or prefabricated units. For further information write Komline-Sanderson Engineering Corp., Peapack, N. J. or circle No. 12-16 on the reply card.



Units handle flows from 20 to 600 gpm

Snow Blower For Michigan Tractor Shovel

A Sno-Thro blower, made by Krause Industries, is mounted on the same pins as the standard loading bucket and can be hooked up or detached in minutes on the Michigan tractor shovel. Weight of the unit is less than a heaped bucket so there is no strain on the boom arms. Municipalities now can handle snow and ice control problems two ways. Using the standard bucket, they can load snow into 8-ft. high haul trucks. Or they can use the blower and heap higher sideboard-equipped trucks, too. Heavy wind-rowed snow can be loaded into trucks at a rate of 12 cubic yards per minute. Models come in 6 or 7-ft. widths powered by 31 to 56-hp Wisconsin air-cooled engines. For further information write to Krause Industries, 1205 Warren St., Baraboo, Wis., or circle No. 12-18 on the reply card.

Direct Drive Chain Saws

The direct drive Hoffco 88M chain saw is available in three chain speeds (2200, 2300 or 2650) with chain bars up to 36 ins. and bow bars of 15 and 18 ins. It is powered by a West Bend 2 cycle engine, complete with all position carburetor and hi-tension magneto, assuring plenty of power. The centered handle control and thumb button oiler makes possible "balanced straight line cutting." When the drive sprocket is worn on the outer edge, it isn't thrown away. The bar is removed, the spacer taken out and the bar replaced. The Model 88M is four pounds lighter than the standard direct drive 88. For further details write Hoffco, Inc., Richmond, Ind., or circle No. 12-19 on the reply card.

Adaptable Utility Tractor

International Harvester Co. has announced a new tractor, the International 300 Utility which delivers an estimated 35 hp at the belt. The 330 utility has the built-in strength and power capacity for handling heavy-duty backhoes, hoisting 4,000-lb. loads with a fork lift, or lifting 1,250-lb. loads with a front-mounted loader. A wide variety of matched equipment adapts the 330 Utility to

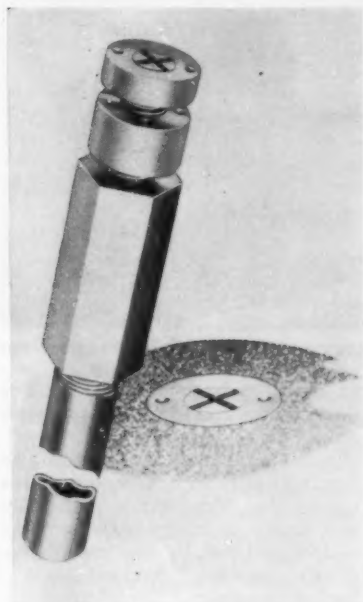


virtually any wheel tractor operation, with over 35 types of utility equipment available, ranging from backhoes, blades, and loaders, to mowers, snow plows, and sweepers. Most of this equipment fits both the 350 Utility and the 330 Utility. For details, write International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or circle No. 12-20.

Quick Connect Couplers

Jordan Kamlok Quick couplers (for fluid or powered solid services) are now available in 6-in. size and are furnished in aluminum and bronze. Other Kamloks are available in ½-in. through 4-in. sizes, in several metals. Coupling is fast, easy and tight with long life. They can be used on hoses, piping and equipment. Full details from Division of OPW Corp., 6013 Wiehe Road, Cincinnati 13, O., or circle No. 12-21 on the reply card.

New Survey Monument, Adjustable to Resurfaced Levels



Adjustable monuments for road surveys

A survey monument, with an adjustable top, eliminating the need of digging and raising monuments to new road levels, is now offered by Charles Bruning Co., Inc., under the trade name "Mark-One." The adjustable top feature permits this monument to be easily and quickly brought to the new level without loss of accuracy of survey points. The monument is designed for use in new or old concrete, macadam and other hard surfaces. Points on a resurfaced road are monumented by turning an adjusting screw of an established monument to a new surface level and adding spacers. A 14-inch pipe extends from the monument body into the sub-grade of the road below, assuring a firm and permanent anchor. Its height adjustability feature and sturdy construction end the problem of lost survey points due to resurfacing or wear. For complete information write Charles Bruning Co., 4700 W. Montrose Ave., Chicago 41, Ill., or circle No. 12-22 on the reply card.

Asbury Traffic Line Shaver

A machine powered by a Wisconsin motor has been developed to remove traffic pattern paint lines from airfields, highways and do other abrading operations. Spread is in excess of 10 ft. per min., depending on the surface. The unit has been announced by Asbury Patent Licensing and Developments. A rotary drum containing pivoted

cutters is held between 2 self-aligning bearings. Attached to a plate is a screw feed mechanism for vertically adjusting the tool which is easily controlled by the operator. On the pivot rods a series of cutters are allowed to pivot freely and find their own depth level. For full details write Asbury Patent Licensing and Developments, 717 Southeast 22nd Ave., Ft. Lauderdale, Fla., or circle No. 12-23 on the reply card.

Chemical Feeder Has A Self-Cleaning Mechanism

A new dry chemical feeder with a self-cleaning feeding mechanism has been introduced by Wallace & Tiernan. The unit will feed at a rate up to 2.85 cubic feet per hour. The self-cleaning feed screw discharges the chemical alternately



Series A-690 chemical feeder

from each end of a feed tube. While one end of the screw is discharging the chemical, the other end is cleaned by being threaded through the material. This feeding mechanism of the A-690 feeder is also designed to prevent chemical flooding. The feed rate is adjustable over a wide range by simply turn-

ing a knob connected to a feed register. The unit has a hopper capacity of 3 1/4 cu. ft. Arching in the hopper is prevented by the action of oscillating diaphragm-type agitators. Two solution chambers are available; a twin jet agitated swirl type chamber and a 25-gallon tank with a triple jet mixer or mechanical mixer. For more data write Wallace & Tiernan, Inc., Belleville, N. J., or circle No. 12-24 on the reply card.

Dempster-Dumpmaster Approaches Automation

Development of the new CA (Clearance Arm) Dumpmaster features an exclusive new cantilever construction of the lifting arms which bridges the cab area, eliminating operational hazards. The Dempster-Dumpmaster System consists of a truck-mounted top-bay compactor body and mechanical lifting arms working in connection with waste-storage containers located at points of waste accumulation throughout the municipality. Moving from one location to another, the driver engages pick-up channels on the sides of the container with the mechanical lifting arms and dumps the contents through the top of the body where waste material is hydraulically compressed. The pick-up, dumping and returning cycle requires less than 60 seconds and is accomplished without the driver leaving the cab. One 6-cu. yd. container holds the equivalent of 40 thirty-gallon trash cans which would require 1.3 man-hours to empty under ideal conditions. Containers are available in 1- through 6-cu. yd. capacities with casters available on all models. The manufacturer has an illustrated descriptive manual. Copies may be obtained by writing Dept. DM-149, Dempster Brothers, Knoxville 17, Tenn. or by circling No. 12-25 on the reply card.



Dumpmaster can load 60 cubic yards of material before traveling to disposal area

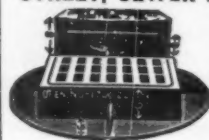
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PUBLIC WORKS Magazine

200 So. Broad St., Ridgewood, N.J.



Portable pedestrian overpass can be used over streets, highways and rail crossings

Pedestrian Overpass

"Sky-Walk," a portable pedestrian overpass, has been announced by C. D. Scarlett Co. The unit can be used over streets and highways and over railroad crossings and streams. It is adaptable to 2, 4, 6 or more traffic lanes and is easily dismantled and re-erected. Clearance is 15 ft. and the portable unit consists of tubular structural members with a 14-gauge steel grating floor. The 5-ft. wide walkways handle 250 persons per min. For further data write C. D. Scarlett Co., Inc., P. O. Box 688, East Lansing, Mich., or circle No. 12-26 on the reply card.

Sno-Whizzer "Rolling Snow Plow"

The Sno-Whizzer, announced by Clayton Industrial Products, operates on the same principle as highway snow-plows. The throwing action of the blade throws snow to either side, right or left. Blade is instantly adjustable up to full 22-degree angle for maximum throwing action; there are 7 possible positions, including 3 right, 3 left, and straight. It removes up to 8 inches of any kind of snow, off any surface. One trip up and back cleans the entire sidewalk, doing more than one hour's shoveling in 5 minutes. It clears an extra-wide 22-in. path. For more details write Clayton Industrial Products Co., 1255 S. Wabash Ave., Chicago, Ill., or circle No. 12-27 on the reply card.

Side Dumping Bucket

A new side dumping bucket attachment for the No. 933 Traxcavator is announced by Caterpillar. Prime advantages of this bucket are in allowing the Traxcavator to perform in-line loading, eliminating the need for constant turning in order to dig and load. As well as increasing production by reducing loading time, this feature also serves

to lower maintenance cost by reducing wear due to turning on track, track parts, steering and master clutches and idlers. Loading is also accomplished with less space required for Traxcavator operation and truck spotting. Side dumping is accomplished by the use of hydraulic cylinder, mounted on the bucket carriage. The bucket is hinged to the carriage and is firmly locked in place when in the conventional digging position. When side dumping is desired, the operator actuates the hydraulic cylinder by the use of a control lever. When actuated, the dumping cylinder unlocks the bucket from the bucket carriage and swings it into a 64° side dumping angle to the left only. The 1½-yard bucket is ramped at a sufficiently steep angle to dump sticky material. For further details write Caterpillar News Service, Peoria, Ill., or circle No. 12-28.



Bucket can also dump in standard way

Civil Engineering Scholarships Available

A \$15,000 yearly civil engineering scholarship program under the supervision of the National Society of Professional Engineers has been established by Armco Drainage & Metal Products. In accepting the Armco scholarship program, the National Society Board of Directors gave approval to a policy authorizing the National Society to solicit and enter into agreements with associations, corporations, foundations, or individuals desiring to make scholarship and fellowship grants in the engineering field. Funds for the first scholarship program will be made available by the Armco Foundation, Incorporated, of Middletown, Ohio. The program involves the establishment of five \$3,000 civil engineering scholarships, to be awarded annually under the supervision of the National Society. Each scholarship will provide a stipend of \$750 per year for recipients engaged in a four-year civil engineering curriculum. Applicants must have the following qualifications: 1) Actual need for substantial financial aid to attend college, 2) A high school record which at the time of application indicates that the student applying is qualified to handle college work, 3) Graduation from high school during the year of application for a scholarship, and 4) A firm decision to enroll in and continue the study of civil engineering at an accredited college or university.

• • •

Technician—Engineer Available

Young man, 25, with two years of college engineering, experienced in transit and level surveys and proficient in drafting desires position with consultant, city, county or state. Prefers location where he can continue his training for an engineering degree; otherwise no choice of location. Not liable for military service. Address Box RH, c/o Public Works, 200 So. Broad St., Ridgewood, N. J. Letters will be forwarded without acknowledgement.

• • •

LINN H. ENSLOW, long-time editor of *Water and Sewage Works*, died Nov. 3 at his farm in Virginia. Member of many technical societies, he was well-known for his wide participation in sanitary engineering activities.



This Jaeger 2PN pumps 10,200 gph through a 2" suction line — all the water a 2" hose can handle. With 2½" hose, it pumps 14,400 gph.

Big New Capacities in Jaeger Pumps

Tests of latest model Jaeger "Sure Prime" centrifugals, reproducing actual job conditions, establish *new high capacities and performance never before guaranteed* to users. For example, a light Model 3XP now pumps 19,500 gph at 10' static suction lift, the Jaeger 6P pump now has an actual performance exceeding 100,000 gph. Base your pump buying on latest information. Sizes 1½" to 10". See your Jaeger distributor or write for catalog.

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NEW! FROM SPARLING!

A MAIN-LINE METER WITH A MAGNETIC PROPELLER DRIVE



The new Sparling Masterflo Main-Line meter features a powerful radial magnet molded as an integral part of the propeller hub. A companion magnet on the drive shaft of the meter permits motion to be transmitted to a sealed transmission from the propeller to the register. This sealed mechanism reduces friction and maintenance. Sparling's new direct mounted Indicator-Totalizer is a standard feature of the Sparling Masterflo Meter. Available in 4" to 24" sizes.

Working pressures, either
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Worth Seeing



Licking a real limiting factor in the new highway program, the time required for design and engineering work that must precede contract letting and construction, is the job of this automatic digital computer of Battelle Memorial Institute, Columbus.



Hauling sulfite liquor, a troublesome waste derivative of the paper manufacturing process, to apply to unimproved roads as a surface stabilizer, is a part of the 17-state operation of Kampo Transit Company. An all-International tank-trailer fleet does the big job in its stride.



Caterpillar No. 12 Motor Grader finish grading the shoulder along a new county road near Mount Pleasant, Florida. This is a particularly pleasant picture to publish as cold weather nears the North.



Presidents, past and present, pause during the International Harvester party at the 63rd annual American Public Works Congress and Equipment Show in Philadelphia recently to have their group picture taken. Left to right, Milton Offner, Sec'y., Board of Public Works, Los Angeles, Calif.; Robert L. Anderson, Director Public Works, Winnetka, Ill., immediate past president; A. H. Rogers, Supt. of Public Works, Garden City, N. Y.; 1958. Association president Sol Ellenson, Director of Public Works, Newport News, Va.; William A. Xanten, Supt. Division of Sanitation, Washington, D. C.; Carl Schneider, Consulting Engineer, New Orleans, La.; and Milton Rosen, Commissioner of Department of Public Utilities, St. Paul, Minn. This was during one of the largest and most successful Congresses ever held, one that will give Kansas City a mark to shoot at next year.

Dodson's Digest



Preparedness is half the battle

We had our first snowfall of the season the other day. It was only a mild one, but enough to put a coating of ice on the roads.

I stopped snowing about noon, so I drove out to see Ed Miller. Ed is a county road commissioner, and I was surprised to find him sitting calmly at his desk, thumbing through a magazine.

"You don't seem very worried about icy roads," I remarked.

"I'm really prepared this year, Dod," Ed explained. "When the ice came today I was ready for it."

"There's nothing like being prepared," I agreed.

"I had all my stockpiles treated with Calcium Chloride last month," Ed went on. "So I had free-flowing abrasives today when I needed them."

"Come to think of it," I said, "I did notice on my way out here that your roads were pretty clear."

"We did the job in a hurry, too," Ed said. "We had all the main roads cleared early."

"You can give Calcium Chloride part of the credit for that," I pointed out. "Nothing melts ice faster than Calcium Chloride."

"I know," Ed agreed. "In fact, I've already ordered enough Calcium Chloride to last me all winter. It sure feels good to be prepared."

Just then the phone rang. It was Ed's wife calling. He didn't look too happy when he hung up.

"I guess I wasn't as prepared as I thought I was," Ed groaned. "I forgot to put Calcium Chloride on my driveway at home this morning. Do you know of a good auto bump shop?"

— L. D. DODSON

P.S.—Our leaflet, "How To Make Icy Surfaces Safe With Wyandotte Calcium Chloride," is full of helpful hints on ice control. To get your free copy, drop me a line today. Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.

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HEADQUARTERS FOR CALCIUM CHLORIDE



by Arthur K. Akers

★ **HIGHLIGHTS** of a long Southern trip: M & H Valve and Fittings Company's bright new office building in Anniston, Ala. . . The sheer number of fine exhibits at the Southwest A.W.W.A. meeting in Oklahoma City. . . The Wylie Manufacturing Company's growing plant in Oklahoma City. . . Mayor Morrison's, and **PUBLIC WORKS** readers Al Weyler, Ned Hughes, and Shelton Hubbard's new offices in New Orleans' magnificent new City Hall.

★ **INFILCO Inc.** has just opened a new 40,000 sq. ft. plant in Salem, Ill., and 10,000 sq. ft. of added general offices space in Tucson, Ariz.

★ **FRANK J. NEWMAN** is named marketing manager, Process Instruments Division, Beckman Instruments, Inc., Fullerton, Calif.

★ **JOHN D. HUCKSTEP, JR.**, is newly-appointed manager of the Portland Cement Association's Advertising Bureau in Chicago.

★ **NATIONAL SLAG ASSOCIATION**, Washington, elected A. W. Wood of National Slag Co., president; C. W. Ireland of Birmingham Slag Division, Vulcan Materials Co., vice-president. E. W. Bauman competently continues as managing director.

★ **RESPONSIBILITY** for keeping highways and streets open and ice-free in winter is being increasingly met by major spreader manufacturers. Latest evidence of this is purchase of 200 spreaders by the State of Pennsylvania from Baughman Mfg. Co. for 60-day delivery.

★ **JOHN MAPEL** is new sales manager, Johnston Pump Co., Pasadena, Calif.

★ **HERBERT H. BLOOM**, former president of Massey-Harris-Ferguson Inc., has been elected president of J. I. Case International, S. A.

★ **THE CLAY SEWER PIPE ASSOCIATION**, Inc. of 17 northern and eastern states elects A. G. (Ted) Cochran president, succeeding Paul R. Rutherford.

★ **WALLACE & TIERNAN's** news is big: Robert T. Browning moves up to executive vice-president; Thomas T. Quigley becomes director, Equip-



Mr. Quigley



Mr. Browning

ment Division, on January 1. Russell C. Clement becomes director of sales, chlorination and chemical feeding equipment on the same date.

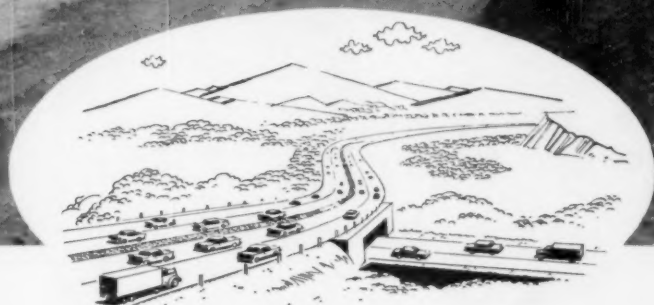
★ **WORLD PREMIERE** of the new 1960 line of J. I. Case Co. was celebrated Nov. 14 in Phoenix, Arizona, culminating a multi-million dollar Product Development Program, according to Executive Vice President Marc B. Rojzman. **PUBLIC WORKS** was proudly present, as were other national publishing and financial figures. Representatives of 3,000 present and prospective dealers were also entertained, starting Nov. 18.

★ **W. S. DICKEY CLAY MFG. CO.**, Kansas City, has purchased the Evens and Howard sewer pipe plant in St. Louis.

★ **GEORGE DEMPSTER**, president of the Dempster-Dumpster organization in Knoxville, not only sees but seizes Opportunity! His winning \$32,000 "in trust" on the Nov. 5th \$64,000 TV program climaxed previous appearances, in one of which guest m.c. Fred MacMurray quipped that he usually got a free sample of any product plugged on the program. What viewers did not know was that Fred was scarcely home before a 6-cubic yard Dempster-Dumpster appeared on his Los Angeles lawn, with the compliments of Mr. Dempster.

★ **A STENOGRAPHER** is a girl you pay while she is learning to type while she is waiting to get married.

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